DOCUMENT RESUME

ED 171 870 UD 019 543

AUTHOR Richards, James M., Jr.; And Others
TITLE An Evaluation of the 1977 Minority Introduction to Engineering Summer Program. Report No. 270.
INSTITUTION Johns Hopkins Univ., Baltimore, Md. Center for Social Organization of Schools.
SPONS AGENCY Engineers' Council for Professional Development, New York, N.Y.
PUB DATE Dec 78
NOTE 100p.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *College Bound Students; Educational Background; *Engineering; High School Students; *Minority Groups; *Program Evaluation; Senior High Schools; *Summer Science Programs
IDENTIFIERS *Minority Introduction to Engineering Program

ABSTRACT

This program brings selected minority high school students to engineering schools all over the United States during the summer between their junior and senior year in high school. The students experience activities which familiarize them with engineering and with college. The evaluation of the program was based on pre- and post-data obtained from self-report questionnaires. The results indicated that the program, Minority Introduction to Engineering (MITE), achieved its main goal of increasing the number of minority students planning to study engineering. A list of participating institutions, sample evaluation forms (including questionnaires) and tables of data are included as part of this program evaluation. (Author/MC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED171870

An Evaluation of the 1977 Minority Introduction to Engineering Summer Program

James M. Richards, Jr.

Gerald D. Williams

John L. Holland

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
J. Hollifield
CSOS
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Report No. 270

Published by the Center for Social Organization of Schools, supported in part as a research and development center by funds from the United States National Institute of Education, Department of Health, Education and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the National Institute of Education, and no official endorsement by the Institute should be inferred.

This evaluation was conducted under a contract between the Engineers Council for Professional Development and the Johns Hopkins University, and was supported, in part, by a grant from the Exxon Corporation to the Engineers Council for Professional Development.

The Johns Hopkins University

Baltimore, Maryland

UD019543

An Evaluation of the 1977 Minority Introduction to Engineering Summer Program

Abstract

The Minority Introduction to Engineering (or MITE) Program brings selected minority high school students to engineering campuses during the summer between their junior and senior years. In programs lasting one to three weeks they experience activities designed to familiarize them both with engineering and with college. This study evaluated the 1977 MITE programs. Results indicate MITE achieved its main goal of increasing the number of minority students planning to study engineering, and provided the most encouragement for studying engineering to those students with the most engineering potential. The participants' own evaluation of MITE was overwhelmingly favorable. The institutions offering MITE programs are typical of engineering institutions in general. The groups of participants served by different MITE institutions are very heterogeneous.

An Evaluation of the 1977 Minority Introduction to Engineering Summer Program

Introduction

In recent years, increasing concern has been expressed about the relatively small number of minority group members in the United States who pursue professional and technical careers. Consequently, numerous efforts have been made to attract students from minority groups to curricula that would prepare them for such careers. Some of these efforts, such as Talent Search, have involved general attempts to attract minority students to college as well as to professional and technical curricula. Other efforts have involved specific attempts to attract minority students to specific curricula and careers. This report summarizes one such specific effort, the Minority Introduction to Engineering (or MITE) program of the Engineers Council for Professional Development.

The MITE program brings selected minority group members to the campuses of engineering colleges during the summer between their junior and senior years in high school. In programs lasting one to three weeks, participants are exposed to a variety of activities designed to familiarize them both with engineering and with college. These programs usually involve some combination of classroom instruction; "show and tell" presentations in which practicing engineers demonstrate interesting apparati; visits to firms employing substantial numbers of engineers; and "hands on" experiences with such devices as computers. Programs vary in the extent to which the classroom instruction is designed to simulate the experience participants would have in college; that is, some programs have required

assignments that are graded by the instructors while other programs do not.

This report describes an evaluation of the 41 different programs (i.e., groups of minority student participants) that were operated by the 30 institutions listed in Appendix A during the summer of 1977. As nearly as we can determine, these programs served a total of 1271 participants. This evaluation is based on pre- and post-MITE data obtained from self-report questionnaires. Also, in one program an attempt was made to conduct a "true experiment" in which participants were randomly chosen from a pool of qualified applicants.

The remainder of this report is organized into six sections which deal with the following questions:

1. What are the major conclusions and recommendations?
2. How were the data collected?
3. What kind of high school junior participated in MITE?
4. What were the MITE programs like?
5. What happened to the MITE participants?
6. What happened in the "true experiment"?

What Are the Major Conclusions and Recommendations?

The results of this evaluation and the experience of the investigators in conducting it imply the following conclusions and recommendations:

1. The evidence indicates that MITE did achieve its main goal of increasing the number of minority students planning to study engineering. The largest single source of new would-be engineers is the group of students previously interested in mathematics and in the physical sciences. There appears to be little basis for a claim that MITE is inappropriately drawing students away from other professional curricula.
2. The participants' own evaluation of MITE was overwhelmingly favorable. We know of no other study obtaining such a positive outcome. This finding is especially impressive in view of the relatively long interval between the end of MITE and the collection of the post-MITE data.
3. The data suggest that MITE provided the most encouragement for going to college to those students with the highest potential for success in college, and the most encouragement for studying engineering to those students with the most engineering potential. These results suggest that MITE does provide participants with a realistic idea of what college and engineering are like. In view of these three conclusions about the impact of MITE, it is strongly recommended that MITE be continued or even expanded. This policy appears especially desirable in view of the engineering profession's goal of reaching parity among engineering graduates as soon as 1985.

4. The limited post-MITE data that are available for non-accepted applicants support the conclusion that this increase in plans to study engineering is a genuine effect of MITE. It is recommended that in future MITE evaluations more emphasis be placed on obtaining follow-up data from rejected applicants.
5. The analyses based on Holland's theory of occupations generally support the preceding conclusions about the effects of MITE.
6. MITE participants had relatively strong academic backgrounds as measured by GPAs, test scores, and number of science and math courses (although their test scores would still be regarded as rather low for a non-minority engineering school applicant). Compared to the average minority student, they also came from relatively privileged backgrounds. This conclusion is supported by a variety of measures including parents' education, parents' occupation, and family income.
7. It seems likely that the characterization reported above is the consequence of programs selecting those participants who have some chance of attaining the math and science background required of engineering freshmen. The data that are available for non-accepted applicants appear consistent with this interpretation, but this comparison is severely limited by the small number of programs that provided data for all applicants. The issue of participant selection is important, so it is strongly recommended that the pre-MITE questionnaire from this study or a similar form be used as a common application form in future evaluations.

8. Given the purposes and emphases of most MITE programs, the characteristics of participants appear appropriate. It should be clearly recognized, however, that MITE is not, to any major extent, a program for salvaging high school dropouts and non-achievers.

9. In general, the institutions offering MITE programs are typical of U.S. engineering colleges and universities. The only significant difference suggests that the environments of MITE institutions are somewhat more "masculine" in the stereotypical sense of the word. Compared to all U.S. colleges and universities, MITE institutions (like other engineering colleges) are larger, more selective, and more scientifically and technically oriented.

10. The groups of participants served by the various MITE institutions appear very heterogeneous. For example, participants in the highest institution on PSAT scores exceeded participants in the lowest institution by 1½ standard deviations; participants in the highest institution on number of math courses had taken more than twice as many such courses as participants in the lowest institution, and so on. This heterogeneity could be of major importance for MITE, so it is important to explore the antecedants and consequences of it. In the present evaluation, detailed analyses were precluded by the small number of institutions obtaining pre-MITE data for all participants. Thus the heterogeneity among programs provides another reason to use a common application form in future evaluations.

11. A low response rate to the post-MITE questionnaire precluded drawing conclusions from the "true experiment." Such experiments are essential to an unequivocal demonstration of the effects of MITE, however, so it is recommended that future MITE evaluations continue to include such experiments for another year or so.

12. Problems of data collection and resulting small Ns are probably inevitable in any given year. Therefore, it is strongly recommended that a more adequate data base be accumulated by using the same pre- and post-MITE questionnaires, or at least a common core of items, for a number of years. For the same reason, it is strongly recommended that all institutions operating MITE programs use the same questionnaires. Using the same questionnaires is more important than is the choice of any particular questionnaires, such as those used in the present evaluation.

How Were the Data Collected?

The primary data collection technique for this evaluation was to administer self-report questionnaires to applicants for and participants in MITE. Three questionnaires were developed. The first was planned for obtaining pre-MITE data from all applicants. The second was planned for obtaining post-MITE data from participants. The intent of the third questionnaire was to provide a comparison group by obtaining post-MITE data from applicants who were not accepted for participation. These questionnaires are reproduced in Appendices B, C, and D.

The experience of behavioral scientists with self-report questionnaires is that respondents may exaggerate the absolute level of their desirable qualities somewhat, but this exaggeration usually is relatively constant across respondents. Therefore, the overall pattern of results is little affected by the exaggeration. For example, if you ask students to report their high school GPA, each of those students might exaggerate their average by about half a letter grade. The ordering of students usually would be preserved, however, and one could use these self-reports to explore the correlation between high school and college GPAs. Since this evaluation is concerned primarily with relationships rather than absolute levels, one should be able to place reasonable confidence in the questionnaire results.

The procedure for collecting pre-MITE data was to provide questionnaires to MITE Program Directors with the hope that these questionnaires would be completed by all applicants. For various reasons, only a few programs were able to administer the questionnaire to applicants, and some programs were unable even to administer the questionnaire to participants.

In those programs that did administer the questionnaires, the most typical procedure appears to have been to distribute the questionnaires to participants on the first day of MITE. No doubt there was some variation in how long participants took to complete the questionnaire and therefore the point in the MITE at which completed questionnaires were returned to the program director. These procedures yielded a total of 996 useable pre-MITE questionnaires from participants. Only 104 useable pre-MITE forms were obtained from applicants who were not accepted for participation.

The post-MITE data were collected by mailing questionnaires to participants (regardless of whether or not they had completed the pre-MITE questionnaire). To maximize response rate, two separate mailings were made to participants. Consequently, the post-MITE data were obtained four to six months after the end of the MITE experience. These procedures yielded 620 useable post-MITE questionnaires from participants, of which 540 came from participants who had completed the pre-MITE questionnaire. Post-MITE data were collected from unaccepted applicants through a single mailing of the followup form. Only 78 useable questionnaires were obtained.

Much of the content of these questionnaires involved standard questions about background, past experiences, goals, and aspirations. The pre-MITE questionnaire also included a number of psychological measures with theoretical or empirical relevance to choice of, success in, and satisfaction with engineering as a career.

The first set of such measures consisted of a check list of nonacademic accomplishments and competencies. A large body of empirical evidence supports the validity of such check lists for predicting multiple

criteria of success outside the classroom (e.g., Holland, 1961; Holland & Astin, 1962; Holland & Nichols, 1964; Richards, Holland & Lutz, 1967; Richards & Lutz, 1968). Each and every item that was included in this check list fell into one or more of the following categories:

A. Items that have been or are currently being used in national assessments of college freshmen (e.g., Bayer, 1972). Examples of such items are: "I placed first in a regional or state science contest," "I edited the school paper, yearbook, or literary magazine," and "I won a varsity letter (sports)."

B. Items that have theoretical or empirical relationships to engineering, science, or leadership. Examples of such items are: "I can adjust a carburetor," "I can explain the 'half-life' of a radioactive element," and "I was elected president of one or more student organizations (recognized by the school)."

C. Items that consultants on previous occasions have suggested to the authors as being accomplishments related to engineering, science, or leadership that high school girls are likely to attain. Examples of such items are: "I can repair furniture," "I can name three foods that are high in protein content," and "I can refinish varnished or stained furniture or woodwork."

D. Items that consultants on previous occasions have suggested to the authors as tapping everyday competence and initiative among minority group high school students. Examples of such items are: "I have paid a bill or purchased something with a money order," "I know the odds for playing craps, poker, and so on," and "I can learn new dance steps easily."

The percents of male and female MITE participants claiming each achievement are presented in Table E-1, Appendix E. Because the number of these competencies and achievements is large, it appeared desirable to classify them into a smaller number of categories or dimensions. Accordingly, the achievements were intercorrelated separately for males and females, and the correlation matrices factor analyzed by the principal axes method with multiple correlations in the diagonal. Cattell's (1966) Scree Test for the number of factors suggested in each case that 4 factors be retained, so in each case that number of factors was rotated to a final solution by the Varimax procedure. The rotated factor solutions are presented in Table E-2, Appendix E.

These factors were given titles that appeared to summarize their basic nature. These titles and an example item from each factor are listed below.

A. Practical Skills - "I can make simple electrical repairs."

B. Scientific Skills - "I placed 1st, 2nd, or 3rd in a school science contest."

C. Communication Skills - "I know how to be a successful leader."

D. Employment Skills - "I have worked regularly for pay."

Table 1 shows the mean and standard deviation for each sex on each of these factors.

Table 1

Means and Standard Deviations by Sex on Non-Academic Competencies and Achievement Scores Scales Derived from Factor Analyses

Scale	No. of Items	Male (N=551)		Female (N=445)	
		$\bar{X}$	SD	$\bar{X}$	SD
Practical Skills	10	4.68	2.80	1.62	1.89
Scientific Skills	4	.53	.88	.45	.81
Communication Skills	4	2.42	1.17	2.41	1.12
Employment Skills	3	1.51	1.10	1.17	1.06

The next set of psychological measures grows out of Holland's (1973) theory of occupational choice. This theory holds that occupational choice, success, and satisfaction are determined, in part, by the degree of a person's resemblance to each of six occupational types. These personality types and some occupations in them are listed below:

A. Realistic - Farmer, Civil Engineer

B. Investigative - Physicist, Electrical Engineer

C. Artistic - Artist, Musician

D. Social - Elementary School Teacher, Social Worker

E. Enterprising - Salesman, Lawyer

F. Conventional - Accountant, Bookkeeper

Holland (1972) has developed the Self-Directed Search (SDS) to measure individual standing on six scales, one for each type. This instrument also yields measures of "Consistency" and "Differentiation." "Consistency" assesses the degree to which the pattern of scores fits together. For example, if a person scoring highest on the Realistic scale is consistent, that person would be expected to have a higher score on Investigative than on Social. "Differentiation" measures the clarity with which a person belongs to a given occupational type in terms of how much higher that person's highest scale score is than his or her lowest scale scores. For purposes of this evaluation, the most important thing to remember is that the higher a person's Consistency and Differentiation scores the more confidence one can have in assigning that person to an occupational type.

Occupations are classified in terms of a three-letter code summarizing the three types they most resemble rather than in terms of resemblance

to a single type. Often these three-letter codes are constructed empirically from the average responses of persons in a given occupation to the six SDS scales or some related empirical technique. In such cases, the first letter is the initial letter in the name of the scale on which the members of the given occupations had the highest average score, the second letter is the initial letter in the scale on which they had the second highest average score, and the third letter is the initial letter of the scale on which they had the third highest average. For example, the code for "Engineer" is IRE, which indicates that on the average engineers score highest on Investigative, second highest on Realistic, and third highest on Enterprising.

In the present study, scores on the six scales were derived for each participant by working backwards from their occupational choices. Both the pre-MITE questionnaire and the post-MITE questionnaire include questions about first occupational choice and several questions that asked: "If you couldn't do that, what would your next choice be?" The three-letter code for each of these choices was determined from Holland's (1972) compilation, and the first letter in the code was assigned a score of 3, the second letter a score of 2, and the third letter a score of 1. Scores for the 6 letters then were summed across occupations and divided by the total number of occupations listed to yield a summary profile. (The maximum number of occupations in this profile on the pre-MITE questionnaire was 6, and the maximum number on the post-MITE questionnaire was 4.) Consistency and differentiation scores also were computed from this summary profile according to Holland's (1972, 1973) standard procedures.

The final set of psychological measures combined non-academic achievement factors, occupational codes, and other pre-MITE information to yield overall estimates of each participant's chances of success in college and in engineering. This effort grows out of a body of research indicating that success in scientific and engineering curricula and careers can be predicted at a high level of accuracy by scoring items of biographical information as if they were test items (e.g., Richards, Cline & Abe, 1963; Taylor, Smith, Ghiselin & Ellison, 1961). On the basis of experience with such research, two a priori biographical information scales were developed to measure respectively College Potential and Engineering Potential. On each item of biographical information in these scales, a score of 1 was assigned to participants to whom that item applied and a score of 0 to participants to whom it did not apply. Scale scores were then computed by summing across items.

Table 2 shows the items in the College Potential scale, the item-total score correlations, and the scale mean, standard deviation, and the reliability for males and females. Table 3 shows the items and the same statistics for the Engineering Potential scale. There is some indication that two Engineering Potential items might be dropped in future studies, but they were retained in this evaluation because they tap the conceptually important areas of non-academic accomplishment and public recognition. Finally, Table 4 summarizes the distribution of scores by sex on these two scales.

Although the reliabilities of these scales are rather low (especially those for Engineering Potential) because of their extreme brevity, they appear satisfactory for research purposes. The score distributions indi-

cate that a good spread and a reasonable approximation to a normal distribution was attained for each scale. Certainly College Potential and Engineering Potential are conceptually important for any evaluation of MITE.

Table 2

Item-Total Score Correlations by Sex for College Potential Scale

Item	Item-Total Score Correlation[a] Males (N=551)	Females (N=445)
1. GPA B+ or better.	.29	.35
2. Says "Very Good Chance" will graduate from college.	.17	.27
3. Father has B.A. or higher degree.	.23	.35
4. Mother has B.A. or higher degree.	.33	.33
5. Family income $10,000 or more.	.20	.27
6. Member of scholastic honor society.	.18	.41
7. High school teachers encouraged college.	.22	.21
8. Won prize or award for scholarship.	.18	.22
9. Parents encouraged college.	.22	.17
10. Communication Skills Scale score two or more.	.25	.18
Total Score $\bar{X}$	5.85	6.11
Standard Deviation	1.91	1.99
KR#20 Reliability	.53	.60

[a] Corrected correlations - i.e., item correlated with total score of remaining items.

Table 3

Item-Total Score Correlations by Sex for Engineering Potential Scale

Item	Item-Total Score Correlations[a] Males (N=551)	Females (N=445)
1. Says "Very Good Chance" will study engineering in college.	.32	.35
2. Preferred field of study has I or R for first letter.	.32	.34
3. Summary Occupational Code has I or R in 3-letter code.	.15	.20
4. Has taken 3 or more math courses.	.18	.28
5. Has taken 2 or more science courses.	.18	.25
6. Says "Researcher" or "Practitioner" will be major work role.	.28	.32
7. At least 1 person encouraged engineering.	.14	.17
8. Found out about MITE through counselor or teacher.	.07	-.02
9a. Male and Practical Skills Scale score 5 or more.	.14	---
9b. Female and Practical Skills Scale score 2 or more.	---	-.01
Total Score Mean	6.15	5.01
Standard Deviation	1.75	1.70
KR#20 Reliability	.46	.49

[a] Corrected correlations, i.e., item correlated with total score of remaining items. Items 2 and 3 refer to different indices, so no part-whole relationship is involved.

Table 4

Score Distributions By Sex on College and Engineering Potential Scales

Raw Score	College Potential				Engineering Potential			
	Males		Females		Males		Females	
	N	%	N	%	N	%	N	%
0	0	0.0	1	0.2	1	0.2	1	0.2
1	9	1.6	2	0.4	3	0.5	10	2.2
2	17	3.1	16	3.6	10	1.8	24	5.4
3	40	7.3	27	6.1	31	5.6	49	11.0
4	63	11.4	52	11.7	54	9.8	87	19.6
5	102	18.5	65	14.6	88	16.0	84	18.9
6	102	18.5	81	18.2	100	18.1	103	23.2
7	108	19.7	90	20.3	129	23.5	61	13.7
8	68	12.3	63	14.2	100	18.1	24	5.4
9	34	6.2	30	6.7	35	6.4	2	0.4
10	8	1.4	18	4.0				
Total	551	100.0	445	100.0	551	100.0	445	100.0

What Kind of High School Junior Participated in MITE?

The main source of data about the initial characteristics of MITE participants was the pre-MITE questionnaire. In addition, the Engineers Council for Professional Development provided data about sex and ethnic category for a few programs that were unable to administer the pre-MITE questionnaires. Table 5 summarizes all available data about the distribution of participants by ethnic category, age, and sex.

Table 5

Distribution of 1977 MITE Participants by Ethnic Category, Age, and Sex

	Males (N=733) %	Females (N=538) %	Total (N=1271) %
Ethnic Category			
Black	69.5	79.0	73.6
Latino	20.3	13.2	17.3
American Indian	4.6	4.7	4.6
Oriental American	2.9	1.1	2.1
Other	2.7	2.0	2.4
Total	100.0	100.0	100.0
	Males (N=547)	**Females (N=442)**	**Total (N=998)**
Age			
16 or Under	12.8	12.9	12.8
17	71.0	77.9	74.1
18	14.6	9.0	12.1
19 or Over	1.6	0.2	1.0
Total	100.0	100.0	100.0

It appears that the modal MITE participant is a 17 year old black male. The second largest group consists of participants with one form or another of Spanish heritage, and the third largest group consists of Native Americans. This rank order probably corresponds to the rank

order for the number of members of these minority groups in the United States.

Table 6 summarizes information about the ways in which participants learned of the MITE program. Most participants seem to have been attracted

Table 6

Source of Information About MITE Program by Sex of Participant

Source	% Citing as Source of Information	
	Males (N=551)	Females (N=445)
Counselors	51.7	53.3
Teachers	24.0	23.6
Principal	2.2	2.5
Newspaper	0.9	0.9
Radio-TV	-	-
Previous Participant	6.5	8.8
Friend	12.7	14.8
Other	26.0	27.9

Note: Participants could name more than one source. Radio-TV named by fewer than 0.1% of participants.

to MITE through the formal school system, with counselors playing a somewhat larger role than teachers.

An obvious question to ask about participants is, "What are their academic backgrounds?" Table 7 indicates participants have relatively strong academic backgrounds. This strong background is clearly evident in the number of science and math courses they have taken and the grades

they have received, and their test scores are high compared to what is expected for minority group members. (Because participants have just finished their junior year in high school, the PSAT results appear especially relevant.) Those test scores still would be regarded as rather low, however, for non-minority applicants to engineering. Therefore, it might be useful for MITE to inform participants that they will face a substantial increase in both competition and expected performance if and when they enter an engineering school.

Table 7

Academic Backgrounds of 1977 MITE Participants by Sex

Variable	Males $\bar{X}$	Males SD	Females $\bar{X}$	Females SD
Grade Point Average	(N=541)		(N=440)	
Overall GPA	3.46	0.48	3.58	0.45
Math GPA	3.40	0.61	3.45	0.59
Science GPA	3.41	0.61	3.50	0.54
Number of Courses Taken in:	(N=551)		(N=445)	
Math	2.93	1.03	2.78	0.97
Science	2.13	0.85	2.15	0.82
Aptitude Test Scores	(N=283)		(N=213)	
PSAT Math	52.51	9.43	49.85	8.47
PSAT Verbal	44.73	9.96	44.88	9.96
SAT Math	542.60	86.47	505.43	80.98
SAT Verbal	463.41	95.15	473.72	93.33

The strong academic background of participants leads to the prediction that participants come from relatively privileged family backgrounds. This prediction is confirmed by the data presented in Table 8, which compares results for participants with national figures for minority groups obtained from the National Longitudinal Study (Levinson, Henderson, Riccobono, and Moore; 1978).

Table 8

Comparison of Parents' Education and Family Income of MITE Participants with National Longitudinal Study Data

Ethnic Category	Father B.S. Degree or More		Mother B.S. Degree or More		Family Income Over $15,000	
	MITE (N=867) %	NLS (N=21,783) %	MITE (N=922) %	NLS (N=21,877) %	MITE (N=597) %	NLS (N=16,549) %
Black	33.6	5.1	35.0	5.3	47.0	6.1
Latino	29.4	5.2	12.1	2.9	30.4	8.6
American Indian	29.2	7.9	17.3	5.4	29.4	17.0
Oriental American	35.3	15.3	5.9	10.1	58.7	24.7

It is clear that participants come from very privileged backgrounds compared to other minority group students. Indeed, non-minority group students from such backgrounds would be regarded as at least above average in socio-economic status. Further confirmation of the high socio-economic status of participants is provided by the more detailed analyses of parental education, occupation, and income that are presented as Tables E-3, E-4, and E-5 in Appendix E.

On the basis of their academic and socio-economic backgrounds, one would expect participants to have very high educational aspirations and to have received strong social support for academic attainment from their families, friends, and schools. The results presented in Tables 9 and 10 support this expectation. 70% to 80% of participants aspire to a masters degree or higher, and more than one out of four aspires to some doctoral degree. Similarly, about 90% of participants have been encouraged to go to college by their parents, and 75% to 80% by high school teachers or counselors.

NOTE-Mean scores on educational aspirations were computed and compared in some subsequent analyses. Table 9 also shows the numerical values assigned to various aspirations in these later computations.

Table 9

Educational Aspirations of 1977 MITE Participants

Education	Males (N = 529) %	Females (N = 42.) %	Numerical Values Assigned to Aspirations in Later Analyses
High School Diploma	0.6	0.5	1
Vocational/technical Program	0.9	1.4	2
Associate Degree	0.2	0.2	3
Bachelor's Degree	19.5	15.7	4
Master's Degree	51.0	46.1	5
Ph.D. or D.Ed.	20.0	18.3	6
MD, DDS, or DVM	7.8	17.8	6

Table 10

Percent of MITE Participants Encouraged to go to College and to Study Engineering by Various Persons

	To Attend College		To Study Engineering	
Encouraged by	Males (N = 551)	Females (N = 445)	Males (N = 551)	Females (N = 445)
Parents	90.6%	92.6%	38.5%	40.2%
Brothers and/or sisters	53.7%	61.8%	23.4%	17.8%
Other relatives	67.9%	72.8%	20.1%	16.9%
Friends	63.5%	69.4%	30.1%	28.1%
High school teachers	77.7%	81.3%	45.0%	42.0%
High school counselors	76.4%	77.3%	50.6%	49.7%
High school principal	35.9%	35.7%	6.5%	5.6%
Others	7.3%	8.5%	4.5%	5.4%

The most likely explanation for the pattern of results presented in Tables 7 to 10 is that most programs have deliberately selected participants who appear likely to meet the requirements for acceptance by and success in an engineering school. In particular, it seems likely that participants have been chosen who have some chance of attaining the math and science background required of engineering freshmen. Given the purposes and emphases of most MITE programs and the age group with which they deal, such selection appears reasonable and appropriate. At the same time, it should be recognized that these data strongly suggest that MITE does not, to any major extent, serve to salvage high school dropouts and nonachievers.

Because a major purpose of MITE is to attract new minority group members to engineering, it is important to explore the fields participants are interested in before they participate in MITE. Accordingly, Tables 11, 12, and 13 summarize participant responses to the following questions:

A. "What field of study interests you the most?"

B. "What field of engineering interests you the most?"

C. "If you couldn't make it in engineering, what other occupations would you try?"

The choice of field of study data in Table 11 were influenced by the fact that a substantial proportion of participants responded in terms of the high school subject that they liked best rather than the field they were most interested in studying in college. Taken at face value, these data indicate that about 50% of participants are most interested in engineering or in mathematics and science. The remainder are scattered among many other fields, rather than being strongly concentrated in a single field, such as pre-medical or pre-law.

Table 11

Most Preferred Pre-MITE Fields of Study
of 1977 Participants

Males	Field	% Choosing
(N = 551)	Engineering	31.0
	Mathematics	18.1
	Science (unspecified)	12.5
	Premedical	3.3
	Chemistry	2.5
	Computer Science	2.5
	Other Fields	30.1

Females	Field	% Choosing
(N = 445)	Mathematics	20.7
	Engineering	18.7
	Science (unspecified)	11.2
	Premedical	7.9
	Computer Science	4.3
	Business	2.7
	Chemistry	2.7
	Prelaw	2.5
	Psychology	2.0
	Other Fields	27.3

Note: Only fields chosen by 2% or more of a given sex are shown separately.

Table 12

Most Preferred Pre-MITE Engineering Specialties
of 1977 Participants

Engineering Field	Males (N=503) %	Females (N=377) %
Aeronautical & Astronautical	8.9	4.2
Agricultural	0.4	0.3
Architectural	4.6	5.0
Bioengineering	4.2	9.0
Ceramic	0.2	0.0
Chemical	15.3	22.0
Civil	15.9	14.3
Computer	2.6	9.8
Electrical & Electronic	27.4	13.8
Industrial	2.4	4.5
Marine	0.6	0.8
Mechanical	11.5	8.8
Metallurgical	0.2	0.3
Mining	0.0	0.0
Nuclear	2.0	2.7
Petroleum	0.2	0.3
Other	3.6	4.2

Table 13

Most Popular Pre-MITE Occupations Other Than Engineering by Sex for 1977 Participants

Occupation	Percentages	
	Males	Females
Physician	9.5	12.4
Lawyer	8.6	8.8
Teacher (all levels)	6.7	10.6
Professional athlete	5.6	-
Airplane pilot	5.2	-
Business administrator	4.2	4.9
Architect	4.1	2.0
Accountant	2.8	5.1
Military service	3.0	-
Nurse	-	3.8
Psychologist	-	3.4
Professional musician	2.1	2.2

Note - 139 different occupations listed by males; 122 different occupations listed by females. Where no figure is given the occupation was chosen by fewer than 2% of the participants.

The data in Table 12 indicate that preferences among engineering specialties are widely scattered with no strong patterns emerging. If we view these choices in terms of Holland's (1973) theory, there may be a slight tendency for females to prefer specialties with a strong Investigative component more, and specialties with a strong Realistic component less, than males, but even this trend is fairly ambiguous.

The data in Table 13 indicate that if participants could not make it in engineering they would try another professional field, especially medicine, law, and teaching. These data serve mainly to confirm the high aspirations and favorable backgrounds of participants.

Finally, Table 14 contrasts results from participants with whatever data are available from applicants who were not accepted. These results are no more than suggestive, for non-accepted applicant data were obtained from only a few programs and thus could reflect the characteristics of those programs more than the characteristics of all non-accepted applicants. (See the data about diversity of programs in the next section of this report.)

This table includes mean scores on self-estimated chances of attending college, graduating from college, and studying engineering. These self-estimates were made on a four-category scale ranging from "No Chance" to "Very Good Chance." Scores from 1 to 4 were assigned to these categories, with 4 indicating "Very Good Chance."

Again taking the data at face value, the results suggest that participants were selected mainly on characteristics that are reflected in test scores. The higher score on Engineering Potential of non-

Table 14

Comparison of Accepted and Non-Accepted Applicants on Pre-MITE Questionnaire

	Accepted		Non-Accepted		
	Mean	S.D.	Mean	S.D.	t
Grade Point Average	(N=883)		(N=92)		
Overall GPA	3.51	0.47	3.29	0.53	4.62**
Math GPA	3.42	0.60	3.01	0.71	5.16**
Science GPA	3.45	0.58	3.15	0.70	3.89**
Number of Courses	(N=996)		(N=104)		
Math	2.86	1.01	2.74	0.92	1.17
Science	2.14	0.84	2.07	0.70	1.01
Test Scores	(N=399)		(N=45)		
PSAT Math	51.37	9.12	37.25	7.52	12.12**
PSAT Verbal	44.80	9.95	34.51	6.22	11.68**
SAT Math	526.72	86.02	410.00	82.51	6.52**
SAT Verbal	467.81	94.36	363.00	75.10	5.20**
Potential Scales	(N=966)		(N=104)		
College Potential	5.96	1.95	4.99	1.85	4.87**
Engineering Pot.	5.64	1.82	6.31	1.51	3.61**
Aspirations	(N=936)		(N=101)		
Level of Education	5.20	1.01	4.91	1.23	2.27*
Chances Will Go to College	3.94	0.27	3.83	0.41	3.56**
Chances Will Graduate	3.91	0.31	3.83	0.40	2.26*
Chances Will Study Engineering	3.43	0.62	3.60	0.49	2.71*

Note: Ns are averaged for each section.
*p < 05
**p < 01

accepted applications almost certainly reflects their own over-estimation of their chances of studying engineering. Such over-estimation could involve either a lack of realism or merely a desire to make a favorable impression.

What Were The MITE Programs Like?

The institutions that provided MITE programs in the summer of 1977 were widely dispersed across the United States, and included both public and private institutions as well as both predominately white and traditionally black institutions. At the same time, all of these institutions provide engineering programs accredited by the Engineers Council For Professional Development and therefore are likely to have important characteristics in common. It appeared interesting to examine the ways in which MITE institutions resembled and differed from each other, and accordingly measures of the characteristics of these institutions were taken from Astin's (1965) compilation. This compilation described college "environments" in terms of eight characteristics: selectivity, size, and six orientations measuring the extent to which student major fields fall into Holland's (1973) six types: realistic, investigative, artistic, social, enterprising, and conventional. Astin's results are based on data collected in 1961, so the one MITE institution established since that year necessarily is excluded. Other research (Richards, Seligman, & Jones, 1970) indicates the kind of college characteristic measured by Astin are quite stable over periods of 25 years, so we can be reasonably confident that Astin's scores still describe the MITE institutions accurately.

Institutional summaries were compiled both including all MITE institutions and excluding the Army, Air Force, Coast Guard, and Naval Academies. (The service academy programs had special purposes, such as increasing minority representation in the officer corps, not shared by other MITE institutions.) Such summaries also were compiled

for two comparison groups. The first was a 25% sample of those four-year colleges and universities listed in a standard reference source (U.S. Office of Education, 1972) that had accredited engineering programs. The second comparison group consisted of the total sample of 1015 institutions included in Astin's study. This sample should accurately represent the population of U.S. four-year colleges and universities. The results for the various groups and the comparisons of MITE institutions (excluding service academies) with engineering colleges and with all U.S. colleges and universities are summarized in Table 15.

These results indicate that MITE institutions resemble U.S. engineering colleges and universities in general, except that MITE schools are significantly lower on Social Orientation. This difference suggests that the environments of MITE institutions are somewhat more "masculine" in the stereotypical sense of the word. Compared to all U.S. colleges and universities, MITE institutions, like other engineering colleges, are larger, more selective, and more oriented to scientific and technical fields. They also appear to be more oriented to business fields and less oriented to the fine and liberal arts and to fields like teacher education. These differences also suggest that MITE institutions are stereotypically "masculine."

The number of separate programs (i.e., groups of participants) offered by MITE institutions varied from 1 to 3, and the length of these programs varied from 1 to 3 weeks. (A "week," however, might be either 5 or 7 days long.) Results for the distribution and length of programs are summarized in Table 16. The modal MITE program lasted two weeks and was the only program offered by its host institution.

Table 15

Comparison of MITE Institutions With

Engineering Colleges and All U.S. Colleges

and Universities

		MITE Colleges				t Tests Comparing MITE Colleges With:	
		All (N=29)	Excluding Service Academies (N=25)	Engineering Schools (N=52)	U.S. Colleges (N=1050)	Engineering Schools	U.S. Colleges
Selectivity	Mean	57.93	56.92	55.92	50.00	0.45	3.42**
	S.D.	8.55	8.70	8.85	10.00		
Size	Mean	61.83	62.92	62.48	50.00	0.27	6.40**
	S.D.	8.19	7.71	5.96	10.00		
Orientations							
Realistic	Mean	65.24	64.48	62.58	50.00	1.37	7.21**
	S.D.	4.34	4.21	6.10	10.00		
Investigative	Mean	51.03	54.40	54.67	50.00	-0.12	2.17**
	S.D.	12.47	9.92	8.08	10.00		
Artistic	Mean	39.48	41.16	42.71	50.00	-0.89	-4.38**
	S.D.	8.46	7.92	6.39	10.00		
Social	Mean	36.66	38.04	41.98	50.00	-2.27*	-5.94**
	S.D.	6.97	6.51	7.17	10.00		
Enterprising	Mean	55.48	51.88	50.52	50.00	0.75	0.93
	S.D.	11.94	8.45	6.57	10.00		
Conventional	Mean	57.14	56.04	54.94	50.00	0.61	2.99**
	S.D.	10.04	7.48	7.16	10.00		

*p< 05
**p< 01

Table 16

Number of Programs by Institution
and Distribution of Programs by Length

Number of Programs Offered by Institution	Institutions Offering N	%
1	21	70.0
2	7	23.3
3	2	6.7
Program Length in Weeks	**Programs N**	**%**
1	14	34.1
2	24	58.6
3	3	7.3

A large body of research and theory (e.g., Astin, 1965; Astin & Holland, 1961; Holland, 1973; Hoyt, 1968) indicates that the student bodies of U.S. colleges and universities vary widely, and that this diversity in student body characteristics is a major determinant of the variation among colleges in overall character or environment. It seemed possible that a similar diversity existed among the participants in programs at the various MITE institutions. Accordingly, statistics summarizing group characteristics were compiled for those institutions with data for 5 or more participants. Table 17 summarizes the results. In these comparisons, participants were taken at their word; that is, if a participant in a program known from other information to be 100% black claimed to be Oriental, that student was classified as Oriental.

These results indicate a high degree of diversity in the composition

of participant groups. For example, the highest group on each PSAT score exceeded the lowest group by about 1 1/2 standard deviations; the highest group on number of science courses had taken more than twice as many such courses as the lowest group; the highest group on family income claimed an income more than $13,000 higher than the lowest group; and the ratio of the highest to lowest group on percent of participants saying the chances are very good they will study engineering was about 5 to 1.

Diversity of this magnitude could strongly affect the experience that participants have in various MITE programs and the impact of the MITE experience, so it appears extremely important to examine the antecedents and consequences of such diversity. Unfortunately, too many institutions are missing from the present data to permit a meaningful examination of these questions. Therefore, it is strongly recommended that future MITE evaluations place special emphasis on obtaining data from participants in all MITE programs and on analyzing the extent and implications of program diversity.

As an example of the kind of analyses that might be performed, the present data were used to examine the correlation between institutional characteristics and average scores of participants on the potential scales. Table 18 summarizes the results. Although none of these correlations was statistically significant, a clear pattern exists that suggests the lack of significance may reflect only the small number of cases. This pattern suggests that the participants with the most potential are concentrated in selective, technically oriented, and stereotypically "masculine" institutions, or, in other words, in the institutions that most typify engineering schools.

Table 17

Variation in Characteristics of the Group of Participants for MITE Institutions

	# of Institutions	Score of Institution with Lowest Score	Score of Institution with Highest Score	Average Score for all Institutions
% of Participants Who Are:				
Male	25	37.5	72.4	57.1
Black	24	0.0	100.0	63.8
Latino	24	0.0	94.7	17.8
Indian	24	0.0	100.0	10.2
Oriental	24	0.0	50.0	4.7
Other	24	0.0	19.0	3.6
Average High School GPA				
Math	20	2.90	3.69	3.33
Science	20	2.88	3.80	3.36
Total	20	2.99	3.75	3.43
Average Test Score:				
PSAT - Math	13	42.64	56.61	49.78
PSAT - Verbal	13	36.75	53.08	43.71
Average # of Courses in:				
Math	20	1.71	3.59	2.86
Science	20	1.20	2.83	2.11
% of Participants Who Say Chances are "Very Good" They Will:				
Go to College	20	71.4	100.0	92.9
Graduate from College	20	52.4	100.0	88.0
Study Engineering	20	13.0	68.4	45.9
Average Number of Persons Encouraged Participant to:				
Go to College	15	3.88	5.77	4.82
Study Engineering	15	1.13	2.85	2.05
Median Family Income	15	$8,999	$22,499	$13,849
Average Score On:				
College Potential	20	3.83	6.93	5.63
Engineering Potential	20	3.63	6.76	5.65

Note - For each variable only institutions with scores for 5 or more participants are included.

Table 18

Correlations Between Institutional Characteristics and Average Potential Scores of Participants (N = 18)

Institutional Characteristic	Correlation With: Average College Potential	Average Engineering Potential
Selectivity	.28	.41
Size	.23	.03
Orientations		
Realistic	.28	.37
Investigative	.29	.29
Artistic	-.23	-.22
Social	-.13	-.46
Enterprising	.05	.15
Conventional	-.19	.08

Note - None of these correlations are statistically significant.

What Happened to MITE Participants?

The assessment of MITE outcomes is based on the data obtained from the post-MITE questionnaire, and it seems important to compare participants who did and did not respond to this questionnaire in order to examine the possibility of bias in the results. Table 19 compares the responses on the pre-MITE questionnaire of participants who did and did not respond to the post-MITE questionnaire. The major trend in this table is for non-respondents to have somewhat lower academic qualifications. They have significantly lower GPAs (both overall and in math) and PSAT math scores, and have taken significantly fewer math courses. They also are significantly lower on the College Potential Scale and on their own estimation of the chances they will graduate from college.

Such a pattern of differences is very common in studies of academic, or quasi-academic programs. It is unsurprising, therefore, that this pattern was obtained in this study, but the pattern does suggest that non-respondents are somewhat less likely to be good prospects for engineering. It is possible that their failure to respond somewhat reduced the number of persons who did not intend to become engineers after MITE and artificially somewhat increased the proportion of participants who did intend to become engineers after MITE. The absolute differences between respondents and non-respondents are small, so it appears unlikely that these differences have seriously distorted the major patterns of results obtained from the post-MITE questionnaires.

The primary goal of the MITE program is to increase the number of minority persons who become engineers. Consequently, the most important criterion for evaluating MITE is whether or not the proportion

Table 19

Responses to Pre-MITE Questionnaire of Respondents and Nonrespondents to Post-MITE Questionnaire

Variable	Respondents		Nonrespondents		
	$\bar{X}$	SD	$\bar{X}$	SD	t
Grade Point Averages	(N=466)		(N=418)		
Overall GPA	3.54	.44	3.48	.49	1.99*
Math GPA	3.46	.58	3.38	.62	1.98*
Science GPA	3.45	.57	3.45	.59	0.09
Number of Courses Taken in:	(N=481)		(N=515)		
Math	2.94	.99	2.77	1.01	2.64**
Science	2.19	.83	2.09	.85	2.05*
Aptitude Tests	(N=221)		(N=176)		
PSAT Math	52.38	9.22	50.15	8.86	2.74**
PSAT Verbal	45.39	9.82	44.09	10.08	1.44
SAT Math	529.53	86.45	523.05	85.66	0.65
SAT Verbal	471.29	96.09	463.28	92.22	0.73
Potential Scales	(N=481)		(N=515)		
College Potential	6.13	1.87	5.79	2.01	2.80**
Engineering Potential	5.70	1.72	5.58	1.91	1.01
Aspirations	(N=489)		(N=447)		
Level of Education	5.26	.97	5.14	1.04	1.87
Chances Will Go To College	3.94	.26	3.93	.28	0,87
Chances Will Graduate From College	3.94	.25	3.87	.36	3.21**
Chances Will Study Engineering	3.45	.57	3.40	.67	1.30

Note - N's are averaged for each section.

* $p < .05$; ** $p < .01$;

of participants planning to study engineering increased. Data pertaining to this criterion are presented in Table 20. Two comparisons are shown, both of which are limited to participants who responded to both the pre- and post-MITE questionnaires. The first set of results compares responses on the pre- and post-MITE questionnaires to free response questions about preferred field of study. The second set compares responses to two questions on the post-MITE questionnaires about intent to study engineering before and after MITE. (The format of the questionnaire somewhat separated these questions.) This second set of data provides some control for non-response to the post-MITE questionnaire.

Table 20

Choice of Engineering as Field of Study Before and After MITE

	Males (N=223)	Females (N=181)
Preferred Field of Study Was Engineering:		
a. Before MITE	38.5%	20.4%
b. After MITE	85.7%	56.9%
Chi Square	87.93**	48.01**
Answered "Yes" to Post-MITE Question:	(N=333)	(N=287)
a. Were you planning to study engineering in college before you participated in MITE?	63.7%	41.1%
b. Are you now planning to study engineering in college?	83.8%	57.5%
Chi Square	32.04**	18.18**

* $<.05$ ** $<.01$

Both sets of data indicate a substantial increase in the proportion of participants choosing engineering as a field of study. It also should be remembered that the post-MITE data were collected four to six months after the end of the MITE experience, so most of the influence of any "hello-goodbye effect" (i.e., a tendency for participants to choose engineering on their last day in MITE without any lasting commitment to the field) should has disipated. Finally, the two post-MITE estimates for each sex of the proportion choosing engineering are in close agreement. Thus, the data in this table provide impressive evidence that MITE is accomplishing its basic goal of increasing the number of minority persons planning to study engineering. The rather large discrepancies in the pre-MITE estimates of the proportion of each sex choosing engineering probably can be attributed mainly to methodological differences. The actual item on the pre-MITE questionnaire read "What field of study interests you most?" and, as noted previously, a significant proportion of students gave the high school subject they found most interesting rather than the field they wanted to study in colleges.

A skeptic, or a methodological purist, might contend that these changes reflect some constant process, and would have occurred even if participants had not attended MITE. Despite the small number of non-accepted applicants who provided post-MITE data, their responses do provide some check on this contention. Relevant data are summarized in Table 21. Although the absolute level for pre-MITE choice of engineering appear somewhat improbable, the key point is that the percent choosing engineering actually decreased. These results for

non-accepted applicants lend support to (although they do not prove) the conclusion that the changes in participants do reflect the impact of MITE.

Table 21

Change in Engineering Plans
for MITE Applicants
Who Were Not Accepted

Post-MITE Question: (N=78)	Answered Yes
a. Were you planning to study engineering before you applied for MITE?	75.6%
b. Are you now planning to study engineering?	64.1%
Chi Square	3.04

Chi Square is not significant.

In view of the strong academic background and high aspirations of MITE participants, one possible criticism of the MITE program might be that all it is accomplishing is turning, say, would-be physicians into would-be engineers. This criticism could be answered on its own level by saying it is better for a person to be a happy, effective engineer than to be an unhappy, ineffective physician. A more complete answer to this criticism can be given by comparing the fields of study chosen by participants before MITE with the extent to which they choose engineering after MITE. The relevant data are summarized in Table 22. The entries in this table indicate that, for example, 4 out of 7, or 57.1%, of males who choose art and architecture before MITE choose engineering after MITE.

Table 22

Pre-MITE Fields of Study and
Post-MITE Choice of Engineering

Field	Males			Females		
	N Choosing Field Before MITE	N Choosing Engineering After MITE	% Choosing Engineering After MITE	N Choosing Field Before MITE	N Choosing Engineering After MITE	% Choosing Engineering After MITE
Arts and Architecture	7	4	57.1	14	6	42.9
Biological Sciences	7	2	28.6	6	3	50.0
Business	-	-	-	8	2	25.0
Engineering	86	82	95.3	37	34	91.9
Mathematics and Physical Science	75	65	86.7	57	34	59.6
Professional	13	10	76.9	24	9	37.5
Social Sciences	4	1	25.0	5	1	20.0
Education	-	-	-	3	0	0.0
Other Fields	31	27	87.1	27	14	51.9

These results indicate that to some extent MITE is attracting participants from nearly all fields. In terms of absolute numbers, however, the major source of new would-be engineers (both male and female) is the group of students previously interested in mathematics and the physical sciences, or, in other words, the group of students who appear most appropriate to attract to engineering. Also, suppose we classify

all students choosing either the Biological Sciences or Professional fields as would-be physicians, surely an over-inclusive classification. Out of 223 male participants shown in Table 22, only 12, or 5.4%, could be classified as would-be physicians attracted by MITE. Similarly, only 12, or 6.6% of the 181 female participants could be classified as would-be doctors attracted by MITE, and the results indicate an even lower per cent were would-be lawyers, businesspersons, and so on who were attracted to engineering. For these reasons, there appears to be little basis for a claim that MITE is inappropriately attracting promising candidates for other professions to engineering.

In addition to increasing the number of minority persons studying engineering, the MITE program has a number of more general goals such as giving participants a clear idea of what engineering is like, familiarizing them with college, and increasing their confidence in their ability to cope with college. Since participants themselves are the best source of information about how well these goals have been attained, it appeared that the best way to assess attainment of these goals would be to ask participants directly. Accordingly, a series of evaluation items was constructed each of which asked participants to indicate their degree of agreement with a statement relevant to these goals on a four-point scale whose categories were "strongly disagree," "disagree," "agree," and "strongly agree." For some analyses, scores from 1 to 4 were assigned to these categories, with 1 always indicating "strongly agree."

Table 23 shows the percent of participants responding "agree" or "strongly agree" to each statement. These results indicate the

participants' own evaluation of MITE is overwhelmingly favorable. In interpreting this pattern, it is again important to remember the relatively long period of time between participation in MITE and collection of the post-MITE data. Again, the "hello-goodbye effect" would lead one to expect participants to have been extremely favorable if

Table 23

% of MITE Participants Responding "Agree" or "Strongly Agree" to Various Evaluation Items

Attitude Item	% Agree Males (N = 331)	% Agree Females (N = 287)
I have a clear idea of what I have to do to go to college.	96.4	93.7
It would be very difficult for a student like me to get good grades in college.	5.1	5.3
I am confident that my current career choice is right for me.	95.5	88.2
I am not good enough at math and science to be an engineer.	4.6	14.9
I have a clear idea of what it is like to be an engineer.	84.0	78.7
I believe that minority groups and women are not welcome in engineering.	2.4	3.2
Attending the MITE program raised my hopes of attending college and having a professional career.	88.8	88.6
I wish I had not participated in MITE	0.0	0.0
I learned a lot about engineers and engineering from the MITE program	97.6	98.6
The MITE experience frequently was unpleasant.	4.2	2.4
I learned some things about myself from the MITE experience	96.0	95.1
The MITE experience made me realize that engineering's not for me.	4.5	18.3
Participating in MITE made college professors, deans, and admissions officers seem more real, human, even likeable.	91.7	92.2
I would recommend the MITE program to a friend.	100.0	99.3

Note: Includes all participants who completed post-MITE questionnaires.

the post-MITE questionnaire had been given on the last day of the program. (That is, the "hello-goodbye effect" would have caused students to suppress whatever honest reservations they had about MITE). This effect usually dissipates rather quickly over time, however, and as a consequence evaluations obtained a few months later usually are noticeably less favorable than evaluations collected immediately after the end of a given program. Therefore, these results presented provide impressive evidence that nearly all participants had a positive experience in MITE, and that nearly all participants view MITE as having achieved much of its broader purpose. Indeed, the authors know of no previous evaluation that obtained such positive responses after such a long interval.

It appeared desirable to treat the participant evaluations more analytically, however, and accordingly the two potential scales were correlated with degree of agreement with the various evaluation items. The sexes were combined in computing these correlations, but sex was treated as a "dummy" predictor variable on which scores of 1 were assigned to males and scores of 0 to females. In addition to the basic correlations, adjusted correlations were computed between the potential scales and the evaluation items that "corrected" for the degree of unreliability, or measurement error, in the potential scores. The purpose of these adjusted correlations was to provide a better estimate of the underlying relationships between the psychological characteristics measured by the potential scales and responses to the evaluation items. The various correlations and adjusted correlations are summarized in Table 24.

Table 24

Correlations Between Degree of Agreement with Evaluation Items and Psycho-Social Characteristics of Participants

Attitudes	College Potential r	Engineering Potential r	Sex r	Adjusted for Unreliability of Potential Scales: College Potential r	Adjusted for Unreliability of Potential Scales: Engineering Potential r
I have a clear idea of what I have to do to go to college.	.141**	.048	-.029	.188**	.070
It would be difficult for a student like me to get good grades in college.	-.191**	-.037	.025	-.254**	-.054
I am confident that my current career choice is right for me.	.082	.175**	.182**	.109*	.254**
I am not good enough at math and science to be an engineer.	-.203**	-.300**	-.191**	-.270**	-.435**
I have a clear idea of what it is like to be an engineer.	.020	.110*	.052	.027	.160**
I believe that minority groups and women are not welcome in engineering.	-.092*	-.053	-.017	-.122*	-.077
Attending the MITE program raised my hopes of attending college and having a professional career.	-.118**	.027	-.013	-.157**	.039
I wish I had not participated in MITE.	-.088	-.063	-.058	-.117*	-.091*
I learned a lot about engineers and engineering from the MITE program.	-.001	.031	.004	-.001	.045
The MITE experience frequently was unpleasant.	-.044	-.004	.010	-.059	-.006
I learned some things about myself from the MITE experience.	-.008	-.071	-.032	-.011	-.103*
The MITE experience made me realize that engineering is not for me.	-.067	-.314**	-.227**	-.089	-.456**
Participating in MITE made college professors, deans and admission officers seem more human, real, even likeable.	-.026	.046	-.040	-.035	.067
I would recommend the MITE program to a friend.	.101*	.002	-.022	.134**	.003

(N = 473) *p<.05; **p<.01

Note - Sex scored so a positive correlation indicates agreeing to a given statement is associated with being male.

The results in Table 24 reveal a clear meaningful pattern. Participants with high scores on College Potential are more likely to say that they have a clear idea of what they have to do to go to college, that their current career choice is right for them, and that they would recommend MITE to a friend; while students with low scores on college potential are more likely to agree that it would be difficult for them to get good grades in college, that they are not good enough at math and science to be an engineer, that minority groups are not welcome in engineering, and that they wish they had not participated in MITE. The only apparent anomaly is that students with low scores are more likely than students with high scores to agree that attending MITE increased their educational and occupational aspirations. Perhaps this anomaly means only that the aspirations of high scoring students were already so high that attending MITE could not increase them much. Overall, the results for College Potential suggest that MITE is providing participants with a realistic impression of their chances for success in college. At the same time, the results suggest that MITE programs should be cautious about inviting students with really low chances of success in college to participate, for MITE could be unpleasant, even destructive, for such students.

Similarly, and perhaps more importantly, participants with high scores on Engineering Potential are more likely to agree that they are confident about their current career choice and that they have a clear idea of what it is like to be an engineer, while students with low scores are more likely to agree that they are not good enough at math and science to be an engineer and that MITE made them realize that

engineering is not for them. In short, it again appears that MITE is providing participants with a realistic impression of engineering and thus is providing the most encouragement to study engineering to the participants who are the best candidates for engineering careers. The correlations for sex suggest that engineering is still a highly "masculine" field; so much so that at least a significant proportion of women still find it incompatible. Consequently, one effect of MITE was to make such women more confident of their judgment that engineering is not for them.

Taken together, the results in Tables 20 to 24 make a persuasive case for the positive impact of MITE on the number of minority group students planning to study engineering. Therefore, it is strongly recommended that the MITE program be continued or even expanded. This policy appears especially desirable in view of the engineering profession's goal of having minority groups represented in graduating classes to the same extent they are represented in the population, with this goal to be achieved as soon as 1985.

In addition to these broad goals, MITE also had some specific objectives. First, MITE strove to encourage participants to take the senior year courses in math and science, especially physical science, that are expected of college freshmen in engineering. Relevant data are summarized in Table 25. It can be seen that a substantial proportion of participants are indeed taking (or planning to take) relevant courses in the year following their MITE experience, but that only about a third of the participants report that they have changed the courses they are taking because of the MITE experience. In view

of the background of the participants, however, perhaps this outcome is as much impact as we could reasonably expect. Certainly the proportion of students reporting an increase in math and/or science is fairly close to the increase in the proportion of students planning to study engineering.

Second, it was hoped that MITE participants would be a source of information about MITE (and about engineering) for people in their home community. Table 26 shows the extent to which participants talked to various people about MITE. These results indicate that a large majority of participants have communicated at least some information about MITE, to family, friends, teachers, and classmates. There is a hint that most of this communication was informal. It may be that this is appropriate and what should be expected, but it also may be that participants should be encouraged to make formal presentations about MITE in classes and assemblies.

It is also reasonable to hope that by giving realistic information about what an engineering career is like MITE will promote satisfaction with career choice whether or not that career choice is engineering. Relevant data are shown in Table 27. Compared to what is expected for high school seniors, these results indicate a high degree of satisfaction with current career choice. Moreover, those participants whose current choice is engineering are, if anything, slightly more satisfied with their current career choice. This high degree of satisfaction implies that MITE participants choosing engineering are likely to persist in that choice. The lower degree of certainty about career choice expressed by females appears consistent with the results described previously.

Table 25

Changes in Senior Year Courses as a Result of MITE and Specific Courses Taken

	Males (N = 333)	Females (N = 287)
Changes in Senior Year Courses as a Result of MITE:		
No Change	67.3%	66.2%
More Math	10.2%	10.1%
More Science	7.2%	9.8%
More Other Courses	3.3%	4.2%
More Math and Science	9.0%	7.7%
More Math and Other	0.6%	1.0%
More Science and Other	0.3%	0.3%
More Math, Science and Other	2.1%	0.7%
Courses Taking or Plan to Take During Senior Year:		
Mathematics		
Algebra	16.8%	15.7%
Plane Geometry	8.4%	8.7%
Solid Geometry	6.0%	5.6%
Trigonometry	41.7%	41.8%
Calculus	44.1%	37.6%
Other Math	27.0%	31.0%
Science		
Biology	15.0%	14.2%
Physics	64.3%	53.3%
Chemistry	34.5%	31.7%
Other Science	10.2%	15.3%

Table 26

People that MITE Participants talked to About Their Mite Experiences

Have Talked to:	Males (N = 333)	Females (N = 287)
Principal	22.8%	20.6%
Teachers	84.7%	86.4%
Counselors	81.7%	79.4%
Parents	97.6%	95.8%
Other Adults	69.1%	71.8%
Friends	98.8%	99.0%
Relatives	78.4%	84.0%
Students	89.5%	87.5%
Classes, Assemblies	18.9%	22.0%

Table 27

Post-MITE Satisfaction with Current Career Choice of 1977 MITE Participants by Sex

	Males (N = 330)		Females (N = 285)	
Satisfaction	Choosing Engineering	All	Choosing Engineering	All
Undecided	1.8%	3.0%	1.1%	4.9%
Dissatisfied and intend to change	0.0%	0.0%	0.0%	0.0%
Dissatisfied but intend not to change	0.4%	0.3%	0.0%	0.0%
Not sure	1.4%	2.7%	5.5%	6.7%
Moderately satisfied but with some reservations	33.6%	32.8%	37.2%	38.2%
Well satisfied with choice	62.8%	61.2%	54.2%	50.2%

To this point the analysis of what happened to MITE participants has focused mainly on outcomes as measured by responses to the post-MITE questionnaire. Several analyses also were performed to examine changes in the responses of participants between the pre-MITE and the post-MITE questionnaires. Although the statistical analysis of change is somewhat controversial (Cronbach and Furby, 1970), computer simulation studies (Richards, 1975, 1976) have demonstrated that such analyses usually yield correct results. In the case of MITE there may be limits on what can be learned through the analysis of change, because both the typical low reliability of all change measures and the "ceiling effects" of the strong academic background and high aspirations of MITE participants may greatly reduce the variation in scores.

Nevertheless, Table 28 summarizes the pre-post comparisons for males and Table 29 the comparisons for females. The major consistent pattern across the sexes involves changes in the occupational code scores. As would be expected if students were moving in the direction of engineering, significant increases occurred for both sexes on the Realistic, Investigative, and Enterprising scores. Significant increases also occurred on the Consistency and Differentiation scores, a pattern which suggests that participants became more likely to persist in their post-MITE occupational choices. One restriction on these results is that two more fields were classified on the pre-MITE questionnaire than on the post-MITE questionnaire, and to some extent the differences in Tables 28 and 29 may reflect this methodological difference. Although it seems unlikely that this procedural difference is a major source of error, any future evaluations should use exactly the same occupational questions on both pre- and post-MITE questionnaires.

Table 28

Pre/Post Comparisons for Male 1977 MITE Participants

Variable	N	Pre-Test -Mean	Post Test Mean
Aspirations			
Level of education	266	5.20	5.12
Chances will go to college	254	3.94	3.98**
Chances will graduate from college	263	3.93	3.92
Chances will study engineering	266	3.59	3.73***
Occupational Code Scores			
Realistic	272	1.10	1.54**
Investigative	272	1.96	2.36**
Artistic	272	0.82	0.40**
Social	272	1.08	0.51**
Enterprising	272	0.71	0.92**
Conventional	272	0.25	0.17**
Consistency	272	2.53	2.64*
Differentiation	272	2.09	2.46**
Work Roles			
Researcher	253	2.46	2.53
Teacher	235	1.69	1.75
Administrator-Supervisor	237	2.24	2.46**
Promotion-Sales	221	1.43	1.62**
Practitioner	243	2.76	2.80

*$p < .05$; **$p < .01$

Table 29

Pre/Post Comparisons for Female 1977 MITE Participants

Variable	N	Pre-Test -Mean	Post Test Mean
Aspirations			
Level of education	223	5.31	5.24
Chances will go to college	215	3.95	3.98
Chances will graduate from college	227	3.95	3.93
Chances will study engineering	227	3.30	3.27
Occupational Code Scores			
Realistic	231	.58	1.05**
Investigative	231	1.73	2.08**
Artistic	231	1.06	.62**
Social	231	1.50	.96**
Enterprising	231	.78	.93**
Conventional	231	.34	.31
Consistency	231	2.41	2.52*
Differentiation	231	2.08	2.39**
Work Roles			
Researcher	214	2.51	2.50
Teacher	197	1.77	1.64*
Administrator-Supervisor	188	2.26	2.24
Promotion-Sales	185	1.45	1.62**
Practitioner	197	2.60	2.62

* $p < .05$; ** $p < .01$

Males, but not females, showed a significant increase in their own evaluation of the chances they will go to college and will study engineering. (Because 4.00 is the highest possible score for these expectations, changes in expectations were clearly subject to a strong "ceiling effect.") Both sexes showed a significant increase in the extent to which they expected "Promotion-Sales" would be a part of their work role. The absolute magnitudes for this activity on the pre- and post-MITE questionnaires suggest that most of the change involved students who said "No Part" ("of my work role") on the pre-MITE questionnaire but changed to "A Minor Part" on the post-MITE questionnaire. These changes appear consistent with the small but significant increases on the Enterprising scale in the occupational codes.

A final analysis used the questions on the post-MITE questionnaire about choice of engineering before and after MITE to classify participants as persisters in, recruits to, and dropouts from engineering, or as persisters in non-engineering. The analysis was further restricted to participants who had responded to both the pre- and post-MITE questionnaires. Responses of the various persister, recruit, and dropout groups to the pre-MITE questionnaire are shown for males in Table 30, and for females in Table 31. The corresponding responses to the post-MITE questionnaire are shown in Table 32 and Table 33 respectively. The pre-MITE results for both males and females suggest that recruits to engineering resemble persisters in engineering more than they resemble persisters in non-engineering. This pattern provides a further indication that MITE is attracting suitable people to engineering. Results for female dropouts also suggest that their change out

of engineering is appropriate. Male dropouts from engineering, however, seem to be more like persisters in engineering than like any other group. Therefore, they may not be the kind of participant that MITE wishes to divert from engineering. Because this group is fairly small in absolute size, it is hard to evaluate the importance of these findings, but they do suggest that future MITE evaluations should pay special attention to male dropouts from engineering. The post-MITE results for both males and females suggest a fairly clear separation into two groups, one consisting of persisters in and recruits to engineering and the other consisting of dropouts from engineering and persisters in non-engineering. Once again the long period between the end of MITE and collection of the post-MITE data suggest that these results represent fairly stable outcomes.

Table 30

Comparisons of Male Engineering Persisters, Recruits, Dropouts and Nonengineering Persisters on Pre-MITE Questionnaire

	Engineering			Nonengineering	
Variables	Persisters (N = 164)	Recruits (N = 73)	Dropouts (N = 18)	Persisters (N = 22)	F
Academic Background					
High School GPA	3.51	3.51	3.34	3.41	0.94
Math Courses	2.98	3.01	3.22	2.77	0.56
Science Courses	2.16	2.26	2.11	1.86	0.28
Potential Scales					
College Potential	6.11	5.97	6.06	5.82	0.88
Engineering Potential	6.65	5.77	5.89	5.32	9.59**
Encouragement To:					
Go to College	4.78	4.84	5.28	4.73	0.77
Study Engineering	2.54	1.51	2.44	1.22	10.49**
Pre-Aspirations					
Level of Education	5.12	5.31	5.17	5.50	1.60
Chances Will Go to College	3.93	3.95	4.00	3.95	0.54
Chances Will Graduate College	3.95	3.84	4.00	3.95	3.46*
Chances Will Study Engineering	3.76	3.37	3.44	3.05	21.03**
Pre-Work Roles					
Researcher	2.51	2.36	2.44	2.36	0.93
Teacher	1.69	1.68	1.62	1.62	0.13
Administrator/ Supervisor	2.29	2.20	2.19	2.15	0.52
Promotion/Sales	1.46	1.38	1.13	1.50	1.43
Practitioner	2.83	2.70	2.69	2.38	5.31**
Pre-Occupational Code					
Realistic	1.18	0.96	1.05	1.06	1.94
Investigative	1.97	1.94	1.79	2.03	0.50
Artistic	0.78	0.90	1.01	0.73	1.45
Social	1.02	1.18	1.20	1.14	1.43
Enterprising	0.71	0.72	0.61	0.77	0.27
Conventional	0.25	0.25	0.14	0.20	0.23
Consistency	2.48	2.54	2.61	2.68	0.71
Differentiation	2.05	2.09	2.06	2.38	2.43

*$p < .05$; **$p < .01$

Table 31

Comparisons of Female Engineering Persisters, Recruits, Dropouts and Nonengineering Persisters on Pre-MITE Questionnaire

	Engineering			Nonengineering	
Variables	Persisters (N = 66)	Recruits (N = 70)	Dropouts (N = 27)	Persisters (N = 75)	F
Academic Background					
High School GPA	3.60	3.64	3.59	3.57	0.33
Math Courses	3.11	2.83	2.74	2.80	1.62
Science Courses	2.15	2.27	2.26	2.21	0.27
Potential Scales					
College Potential	6.09	6.41	6.04	6.25	0.42
Engineering Potential	6.14	5.03	4.56	4.27	19.17**
Encouragement To:					
Attend College	4.97	4.76	5.15	5.17	0.63
Study Engineering	2.36	2.17	1.93	1.64	3.05*
Pre-Aspirations					
Level of Education	5.22	5.52	5.27	5.26	0.99
Chances Will Go to College	3.93	4.00	3.91	3.93	1.04
Chances Will Graduate College	3.97	3.94	3.92	3.94	0.31
Chances Will Study Engineering	3.73	3.30	3.00	2.97	30.59**
Pre-Work Roles					
Researcher	2.57	2.51	2.58	2.42	0.75
Teacher	1.64	1.81	1.68	1.84	0.95
Administrator/ Supervisor	2.28	2.32	2.11	2.22	0.60
Promotion/Sales	1.51	1.37	1.56	1.42	0.75
Practitioner	2.81	2.75	2.46	2.26	10.46**
Pre-Occupational Code					
Realistic	0.74	0.59	0.39	0.46	5.60**
Investigative	1.80	1.91	1.45	1.61	3.52*
Artistic	1.00	1.04	1.08	1.15	0.80
Social	1.24	1.42	1.67	1.74	11.43**
Enterprising	0.82	0.68	0.85	0.80	0.86
Conventional	0.40	0.32	0.54	0.23	3.33*
Consistency	2.42	2.36	2.41	2.45	0.34
Differentiation	2.01	2.16	2.13	2.09	1.01

*$p < .05$; **$p < .01$

Table 32

Comparisons of Male Engineering Persisters, Recruits, Dropouts and Nonengineering Persisters on Post-MITE Questionnaire

	Engineering			Nonengineering	
Variables	Persisters (N = 164)	Persisters (N = 73)	Dropouts (N = 18)	Persisters (N = 22)	F
Post Aspirations					
Level of Education	5.03	5.22	4.94	5.55	2.61*
Chances Will Go to College	3.98	3.97	4.00	3.95	0.29
Chances Will Graduate From College	3.93	3.90	3.94	3.95	0.27
Chances Will Study Engineering	3.92	3.89	2.78	2.50	119.05**
Post Work Roles					
Researcher	2.55	2.52	2.44	2.33	1.03
Teacher	1.73	1.84	1.61	1.74	0.89
Administrator/ Supervisor	2.44	2.35	2.56	2.55	0.84
Promotion/Sales	1.61	1.61	1.63	1.58	0.02
Practitioner	2.88	2.84	2.35	2.33	11.82**
Post-Occupational Code					
Realistic	1.66	1.58	1.20	0.90	15.05**
Investigative	2.46	2.37	2.08	2.03	4.72**
Artistic	0.33	0.42	0.54	0.71	4.30**
Social	0.39	0.51	0.77	1.23	19.44**
Enterprising	0.94	0.91	1.03	0.84	0.69
Conventional	0.16	0.24	0.52	0.40	2.62*
Consistency	2.68	2.62	2.50	2.57	0.51
Differentiation	2.50	2.41	2.30	2.43	1.25

*$p < .05$; **$p < .01$

Table 33

Comparisons of Female Engineering Persisters, Recruits, Dropouts and Nonengineering Persisters on Post-MITE Questionnaire

	Engineering			Nonengineering	
Variables	Persisters (N = 66)	Recruits (N = 70)	Dropouts (N = 27)	Persisters (N = 75)	F
Post Aspirations					
Level of Education	4.95	5.28	5.44	5.30	2.32
Chances Will Go to College	3.97	4.00	4.00	3.96	1.22
Chances Will Graduate College	3.92	3.94	3.96	3.91	0.39
Chances Will Stud, Engineering	3.88	3.83	2.19	2.56	117.81**
Post Work Roles					
Researcher	2.62	2.56	2.25	2.31	4.22**
Teacher	1.67	1.51	1.65	1.76	1.78
Administrator/ Supervisor	2.29	2.25	2.15	2.18	0.38
Promotion/Sales	1.59	1.57	1.58	1.62	0.05
Practitioner	2.80	2.90	2.15	2.29	15.10**
Post-Occupational Code					
Realistic	1.15	1.30	0.48	0.58	70.35**
Investigative	2.39	2.40	1.36	1.75	19.61**
Artistic	0.34	0.49	0.89	0.90	13.44**
Social	0.53	0.63	1.52	1.49	46.65**
Enterprising	0.96	0.93	1.08	0.86	0.74
Conventional	0.25	0.21	0.67	0.34	7.00**
Consistency	2.56	2.57	2.58	2.41	1.55
Differentiation	2.40	2.50	2.21	2.34	2.14

*$p < .05$; **$p < .01$

What Happened in the "True Experiment?"

In the strictest methodological sense, one cannot be sure whether the outcomes described earlier are the consequences of MITE or the consequences of the kind of student selected to participate in MITE. Providing a rigorous answer to the question of the effects of MITE would require a true experiment in which applicants, or at least applicants judged to be qualified, are assigned randomly to MITE and non-MITE groups.

As part of this evaluation, one program agreed to perform such a true experiment in choosing its participants. More specifically, application materials were used to define a pool of applicants who met minimum qualifications for participating in MITE. Then standard random number procedures were used to select 25 students of whom 22 actually became participants. In addition, for various "political" reasons (such as maintaining good relations with feeder high schools) 12 participants were chosen on the basis of that program's regular selection procedures.

The original plan of this evaluation called for detailed analyses of the randomly chosen group, and detailed comparisons of this group with other MITE participants. Unfortunately, these detailed analyses and comparisons were precluded by a very small response rate of the randomly chosen participants to the post-MITE questionnaire. Only 8 out of the 22 members of this group responded (8 of 12 of the regular group in this program also responded). Although this low response rate precludes drawing any firm conclusions, it did appear desirable at least to tabulate the data that are available. The most appropriate form

for this tabulation appeared to be a comparison of randomly and non-randomly chosen participants within this particular program. Accordingly Table 34 summarizes the pre-MITE comparisons and Table 35 the post-MITE comparisons.

As would be expected, none of the comparisons are statistically significant. Even given the small Ns, however, the similarity of the two groups is striking. If such results had been obtained with a larger, more nearly complete group of randomly chosen participants, those results would have provided impressive evidence for the impact of MITE. Therefore, it appears highly desirable to conduct such a "true experiment" for another year or two, placing special emphasis on obtaining a good post-MITE response rate from randomly chosen participants.

Table 34

Comparisons of Randomly Chosen and Nonrandomly Chosen Participants in a MITE Program Pre-MITE Questionnaire

Variables	Random (N = 22) Mean	Random (N = 22) SD	Nonrandom (N = 11) Mean	Nonrandom (N = 11) SD
Academic Background				
High School GPA	3.20	0.70	3.41	0.49
Math Courses Taken	2.91	0.87	3.17	0.72
Science Courses Taken	2.45	0.86	2.25	0.96
Potential Scales				
College Potential	6.05	1.36	6.00	1.28
Engineering Potential	6.41	1.53	6.42	1.17
Encouragement To:				
Go to College	6.00	1.35	5.33	1.16
Study Engineering	3.18	1.84	2.25	1.14
Pre-Aspirations				
Level of Education	5.57	0.87	5.17	0.94
Chances Will Go to College	3.95	0.21	4.00	0.00
Chances Will Graduate From College	3.95	0.21	3.92	0.29
Chances Will Study Engineering	3.59	0.50	3.50	0.52
Pre-Work Roles				
Researcher	2.30	0.73	2.58	0.52
Teacher	1.58	0.69	1.67	0.49
Administrator/Supervisor	2.29	0.78	2.45	0.52
Promotion/Sales	1.21	0.42	1.18	0.60
Practitioner	2.90	0.30	2.82	0.41
Pre-Occupational Code				
Realistic	0.83	0.76	0.74	0.67
Investigative	1.90	0.59	1.82	0.59
Artistic	0.84	0.50	0.99	0.50
Social	1.33	0.60	1.30	0.57
Enterprising	0.72	0.58	0.75	0.66
Conventional	0.37	0.39	0.39	0.45
Consistency	2.27	0.70	2.42	0.67
Differentiation	2.04	0.47	1.93	0.57

Note: None of the comparisons were significantly different.

Table 35

Comparisons of Randomly Chosen and Nonrandomly Chosen Participants in a MITE Program on Post-MITE Questionnaire

	Random (N = 8)		Nonrandom (N = 8)	
Variables	Mean	SD	Mean	SD
Post-Aspirations				
Level of Education	5.50	1.70	5.13	0.99
Chances Will Go to College	4.00	0.00	4.00	0.00
Chances Will Graduate From College	4.00	0.00	3.75	0.46
Chances Will Study Engineering	3.75	0.46	3.75	0.46
Post-Work Roles				
Researcher	2.57	0.54	2.75	0.46
Teacher	1.38	0.74	1.57	0.54
Administrator/Supervisor	2.75	0.46	2.29	0.95
Promotion/Sales	1.43	0.54	1.57	0.54
Practitioner	2.63	0.74	2.63	0.74
Post-Occupational Code				
Realistic	1.23	0.28	1.54	0.50
Investigative	2.31	0.64	2.61	0.63
Artistic	0.28	0.25	0.17	0.24
Social	0.74	0.27	0.50	0.54
Enterprising	0.99	0.44	0.99	0.65
Conventional	0.45	0.53	0.19	0.37
Consistency	2.50	0.76	2.38	0.92
Differentiation	2.16	0.71	2.68	0.50

Note - No significant difference in comparisons.

References

Astin, A.W. Who goes where to college. Chicago,Ill: Science Research Associates, 1965.

Astin, A.W. & Holland, J.L. The Environmental Assessment Technique: A way to measure college environments. Journal of Educational Psychology, 1961, 52, 308-316.

Bayer, A.E. The black college freshman: Characteristics and recent trends. American Council on Education Research Reports, 1972, 7, No. 3.

Cattell, R.B. The scree test for the number of factors. Multivariate Behavioral Research, 1966, 1, 245-276.

Cronbach, L.J. & Furby, L. How should we measure change--or should we? Psychological Bulletin, 1970, 74, 68-80.

Holland, J.L. Creative and academic performance among talented adolescents. Journal of Educational Psychology, 1961, 52, 136-147.

Holland, J.L. Professional manual for the Self-Directed Search. Palo Alto, Calif.: Consulting Psychologists Press, 1972.

Holland, J.L. Making vocational choices: A theory of careers. Englewood Cliffs, N.J.: Prentice-Hall, 1973.

Holland, J.L. & Astin, A.W. The prediction of academic, artistic, and social achievement of undergraduates of superior scholastic aptitude. Journal of Educational Psychology, 1962, 53, 132-143.

Holland, J.L. & Nichols, R.C. Prediction of academic and extra-curricular achievement in college. Journal of Educational Psychology, 1964, 55, 55-65.

Hoyt, D.P. Description and prediction of diversity among four-year colleges. Measurement and Evaluation in Guidance, 1968, 1, 16-26.

Levensohn, J.R.; Henderson, L.B.; Riccobono, J.A.; & Moore, R.P. National Longitudinal Study: Data file users manual. Washington, D.C.: National Center for Educational Statistics, 1978.

Richards, J.M., Jr. A simulation study of the use of change measures to compare educational programs. American Educational Research Journal, 1975, 12, 299-311.

Richards, J.M., Jr. A simulation study comparing procedures for assessing individual educational growth. Journal of Educational Psychology, 1976, 68, 603-612.

Richards, J.M., Jr.; Cline, V.B.; & Abe, C. Biographical information in the prediction of accomplishment in high school science. Educational and Psychological Measurement, 1963, 23, 789-798.

Richards, J.M., Jr.; Holland, J.L.; & Lutz, S.W. Predicting student accomplishment in college. Journal of Educational Psychology, 1967, 58, 343-355.

Richards, J.M., Jr. & Lutz, S.W. Predicting student accomplishment in college from the ACT assessment. Journal of Educational Measurement, 1968, 5, 17-19.

Richards, J.M., Jr.; Seligman, R.; & Jones, P.K. Faculty and curriculum as measures of college environment. Journal of Educational Psychology, 1970, 61, 324-332.

Taylor, C.W.; Smith, W.R.; Ghiselin, B.; & Ellison, R.L. Explorations in the measurement and prediction of the contributions of one sample of scientists. USAF, AFSC, Personnel Lab., Lackland Air Force Base, ASD-TR-61-96, 1961.

U.S. Office of Education. Education directory 1972-73: Higher education. Washington, D.C.: U.S. Government Printing Office, 1972.

APPENDIX A

PARTICIPATING INSTITUTIONS

University of Alaska

University of Arkansas

University of California, Irvine

University of California, Los Angeles

Clarkson College of Technology

Georgia Institute of Technology

University of Houston

Howard University

University of Illinois

LaFayette College

Lehigh University

University of Maryland

Massachusetts Institute of Technology

University of Massachusetts

University of New Mexico

New Mexico State University

North Carolina State University

University of Notre Dame

University of Oklahoma

Prairie View A and M University

Purdue University

Rochester Institute of Technology

Tulane University

U.S. Air Force Academy

U.S. Coast Guard Academy

U.S. Military Academy

U.S. Naval Academy

Vanderbilt University

Villanova University

University of Washington

APPENDIX B

PRE-MITE QUESTIONNAIRE

28. *(Continued)*

- ☐ I can repair furniture.
- ☐ I can make simple repairs on a TV set.
- ☐ I can use woodshop power tools such as a power saw or lathe.
- ☐ I know how to use electrical test meters (volt, amp. ohm).
- ☐ I can adjust a carburetor.
- ☐ I can refinish varnished or stained furniture or woodwork.
- ☐ I can read blueprints.
- ☐ I can make simple electrical repairs.
- ☐ I can make mechanical drawings.
- ☐ I can name three foods that are high in protein content.
- ☐ I can explain the "half-life" of a radioactive element.
- ☐ I can program a computer.
- ☐ I can explain how to integrate a mathematical function.
- ☐ I can use a microscope.
- ☐ I can explain why some man-made satellites do not fall to the earth.
- ☐ I can play a musical instrument.
- ☐ I can sketch people so they can be recognized.
- ☐ I am good at explaining things to others.
- ☐ I have won a prize or award for scholarship.
- ☐ I was elected president of one or more student organizations (recognized by the school).
- ☐ I received a high rating (good, excellent) in a state music contest.
- ☐ I placed first, second or third in a school science contest.
- ☐ I participated in a state or regional debate contest.
- ☐ I had a major part in a play.
- ☐ I won a varsity letter (sports).
- ☐ I did an independent scientific experiment (not as part of a course).
- ☐ I won a prize or award in an art competition.
- ☐ I edited the school paper, yearbook, or literary magazine.
- ☐ I had poems, stories, essays, or articles published.
- ☐ I participated in a National Science Foundation summer program.
- ☐ I placed first, second, or third in a regional or state science contest.
- ☐ I was a member of a scholastic honor society.
- ☐ I won a prize or award (of any kind) for scientific work or study.

List below any other important activities, achievements, and honors or recognition that apply to you. (Attach additional sheets if necessary).

_____

_____

_____

_____

_____

_____

74

29. How did you find out about **MITE**?
(Check all that apply)

- ☐ Counselor
- ☐ Teacher
- ☐ Principal
- ☐ Newspaper
- ☐ Radio
- ☐ TV
- ☐ Previous participant
- ☐ Friend

Other (specify)_____

30. Will you be attending summer school when not attending **MITE**? ☐ Yes ☐ No

31. Will you be working in a summer job when not attending **MITE**? ☐ Yes ☐ No
If "No" did you try to get a job but were unable to?
☐ Yes ☐ No

32. Name and address of close friend and/or relative apt to know your address for the next two to three years:

_____

_____

_____

_____

_____
Signature of Applicant

Please Return To:

By:

(Form may be reproduced if needed.)

MITE

Application for MITE
(Minority Introduction to Engineering)

Please fill out and return in the enclosed addressed, stamped enve lope. **MITE** applicants, who have failed to complete and return thi form cannot be considered eligible for the programs.

Program Applied for:_____

Dates of Program:_____

1. Applicant:_____ ☐ Male ☐ Female
Last Name First Name Middle In.
Social Security Number:_____

2. Home Address:_____
No. and Street
_____
City State Zip
Telephone No:_____ Area Code:_____

3. Circle the group to which you belong:
Black Latino American Indian Oriental American
Other (specify)_____

4. Name of parent or guardian:_____

5. Address of parent or guardian:_____
No. and Street
_____
City State Zip

6. High school you are now attending:
Name:_____
Address:_____
No. and Street
_____
City State Zip

7. Will you complete your junior year before the summer program takes place and enter your senior year next fall? ☐Yes ☐No

8. What has been your overall average grade so far in high school?
☐A or A+ ☐B+ ☐B– ☐C
☐A– ☐B ☐C+ ☐D

9. Please indicate which of the following specific courses you have studied or are now studying and the grade you obtained in each:
☐ Algebra _____ ☐ Biology _____
☐ Plane Geometry_____ ☐ Physics _____
☐ Solid Geometry _____ ☐ Chemistry _____
☐ Trigonometry _____ ☐ Other science _____
☐ Other math _____ (specify)_____
(specify)_____

Please indicate which of the following tests you have taken and the scores you obtained in each:

PSAT	SAT	ACT
☐ Math_____	☐ Math_____	☐ English_____
☐ Verbal_____	☐ Verbal_____	☐ Math_____
		☐ Social Studies_____
		☐ Natural Science_____

What is the highest level of education you expect to complete?

- ☐ High school diploma
- ☐ Vocational or Technical program
- ☐ Associate degree
- ☐ Bachelor's degree (B.A., B.S., etc.)
- ☐ Master's degree (M.A., M.S., etc.)
- ☐ Doctor of Philosophy or Education (Ph.D. or Ed. D.)
- ☐ Doctor of Medicine, Dentistry, etc. (M.D., D.D.S., or D.V.M.)
- ☐ Law degree (LL.B. or J.D.)
- ☐ Bachelor of Divinity (B.D.)
- ☐ Other (specify)_____

What field of study interests you the most?_____

What field of engineering interest you the most?_____

What other fields of engineering interest you?_____

_____

If you couldn't make it in engineering, what other occupations would you try?

1st Choice:_____

2nd Choice:_____

List below any other occupations you have considered in thinking about your future. List the careers you have daydreamed about as well as those you have discussed with others:

_____

_____

_____

_____

What is your best guess as to the chances you will go to college, graduate from college, and study engineering in college?

	College	Graduate from College	Study Engineering in College
Very good chance	☐	☐	☐
Some chance	☐	☐	☐
Very little chance	☐	☐	☐
No chance	☐	☐	☐

Have you sent in an application for admission to college?
☐Yes ☐No

If Yes, where?_____

when?_____

19. Do you plan to apply for admission to a college? ☐Yes ☐No

If Yes, where?_____

when?_____

20. Please indicate if any of the following persons has encouraged you to go to college and to study engineering. (Check as many as apply):

	Have encouraged me to: Go to college	Study Engineering
Parents	☐	☐
Brothers and sisters	☐	☐
Other relatives	☐	☐
Friends	☐	☐
High school teachers	☐	☐
High school counselor	☐	☐
High school principal	☐	☐
Other (specify)	☐	☐

21. The following roles cut across a number of jobs. Which ones do you anticipate will be part of your work? (Check one answer for each role).

	Not a part of my work	A minor part of my work	A major part of my work
Researcher	☐	☐	☐
Teacher	☐	☐	☐
Administrator or Supervisor	☐	☐	☐
Promoter or Salesman	☐	☐	☐
Practitioner (e.g. practicing engineer)	☐	☐	☐

22. How old will you be on December 31 of this year?

- ☐ 16 or younger
- ☐ 17
- ☐ 18
- ☐ 19
- ☐ 20
- ☐ 21
- ☐ Older than 21

23. Where were you born?_____

24. What was the highest educational level your parents or guardians reached? (Answer for the persons you are living with or lived with most recently).

	Male parent or guardian	Female parent or guardian
Grade school or some high school	☐	☐
High school diploma	☐	☐
Vocational or business school	☐	☐
Some college	☐	☐
Bachelor's degree	☐	☐
Some graduate or professional school (M.A. or less)	☐	☐
Graduate or professional degree	☐	☐
Don't know	☐	☐

25. What are the specific occupations of your parents or guardians? State exactly what they do and where they work: "sells clothes in a department store," "does chemical research fo an oil company," "housewife at home," "deceased," "unemployed," etc.

Male parent or guardian:_____

_____

_____

Female parent or guardian:_____

_____

_____

26. Please check the approximate combined yearly income of your parents or guardians: (Check one).

- ☐ Less than $2,500
- ☐ $ 2,500 – $ 3,999
- ☐ $ 4,000 – $ 5,999
- ☐ $ 6,000 – $ 7,999
- ☐ $ 8,000 – $ 9,999
- ☐ $10,000 – $14,999
- ☐ $15,000 – $19,999
- ☐ $20,000 – $24,999
- ☐ $25,000 or more
- ☐ I don't know

☐ I consider this information confidential.

27. Employments you have held. (Give dates, type of work, where and by whom employed).

_____

_____

_____

_____

_____

28. The following list includes activities, competencies, and accomplishments that might possibly apply to your high school years. Check each item that applies to you. Do not be discouraged by the list, it covers many areas of interest that will apply to only a few students.

- ☐ I have used simple tools, such as a saw or hammer to build or repair something.
- ☐ I have changed a part on a car engine, such as a battery, spark plug, water pump, or generator.
- ☐ I have helped others to solve their personal problems.
- ☐ I have taken apart and reassembled clocks, radios, or other devices.
- ☐ I have paid a bill or purchased something with a money order.
- ☐ I have worked regularly for pay.
- ☐ I have had a job when my friends wanted a job and couldn't find one.
- ☐ I have earned one or more raises or promotions because of good work.
- ☐ I know the odds for playing craps, poker, and so on.
- ☐ I can learn new dance steps easily.
- ☐ I know how to be a successful leader.

APPENDIX C

FOLLOW-UP QUESTIONNAIRE FOR PARTICIPANTS

MITE PROGRAM FOLLOWUP QUESTIONNAIRE

Program Attended: _____
Student's name: _____
Address: _____
_____
City State Zip

Social Security Number: _____

Are you (check one)...? Female _____ Male _____

Name of your high school: _____
Address: _____
_____
City State Zip

EDUCATIONAL PLANS

Use checks to indicate your best guess as to the chances you will go to college, graduate from college, and study engineering in college.

	1. No Chance	2. Very little Chance	3. Some Chance	4. Very good Chance
Go to college	_____	_____	_____	_____
Graduate from college	_____	_____	_____	_____
Study engineering in college	_____	_____	_____	_____

What is the highest level of education you expect to complete (check one)?

High school diploma	_____	Doctor of Medicine, Denistry, etc.	_____
Vocational or technical program	_____	(M.D., D.D.S., or D.V.M.)	_____
Associate degree	_____	Law degree (LL.B. or J.D.)	_____
Bachelor's degree (BA, RS, etc.)	_____	Bachelor of Divinity (B.D.)	_____
Master's degree (MA, MS, etc.)	_____	Other (specify)	_____
Doctor of Philosophy or Education (Ph.D. or Ed.D.)	_____	_____	

Were you planning to study engineering in college before you participated in MITE?

No _____ Yes _____

Have you sent in an application for admission to college?

No _____ Yes _____

If yes, where? _____
when? _____
what field of study? _____

If no, do you plan to apply for admission to college?

No _____ Yes _____

If yes, where? _____
when? _____

Did you make any changes in the courses you are taking or will take this year as a result of partipating in MITE?

No _____
Yes, more math _____
Yes, more science _____
Yes, other (specify) _____

_____

Are you now planning to study engineering in college?

No _____ Yes _____

Check the courses in math or science you are now taking or will take this year:

Algebra	_____	Biology	_____
Plane geometry	_____	Physics	_____
Solid geometry	_____	Chemistry	_____
Trigonometry	_____	Other science (specify)	_____
Calculus	_____		
Other math (specify)	_____	_____	

_____

VOCATIONAL PLANS

My present career choice is (if possible, name an occupation):

_____

If I could not have my first career choice, I would select the following occupation:

_____

If I could not have my first 2 career choices, my third choice would be:

_____

Are you interested in engineering as a career?

No _____ Yes _____

If yes, what fields of engineering interest you the most?

1st choice: _____
2nd choice: _____
3rd choice: _____

How satisfied are you with your present choice of a career (check one)?

Well satisfied with choice _____
Moderately satisfied but with some reservations _____
Not sure _____
Dissatisfied but intend to remain _____
Dissatisfied and intend to change _____
Undecided about future career _____

The following roles cut across a number of jobs. Which ones do you anticipate will be part of your work (check one answer for each role)?

Roles:	1. Not a part of my work	2. A minor part of my work	3. A major part of my work
Researcher	____	____	____
Teacher	____	____	____
Administrator or Supervisor	____	____	____
Promoter or Salesman	____	____	____
Practitioner (e.g. Practicing engineer)	____	____	____

OPINIONS ABOUT COLLEGE AND ENGINEERING

We need your opinions about the following sentences. Put a check in the blank by each sentence that best expresses your opinion.

	1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree
I have a clear idea of what I have to do to go to college	____	____	____	____
It would be very difficult for a student like me to get good grades in college	____	____	____	____
I am confident that my current career choice is right for me	____	____	____	____
I am <u>not</u> good enough at math and science to be an engineer	____	____	____	____
I have a clear idea of what it is like to be an engineer	____	____	____	____
I believe that minority groups and women are <u>not</u> welcome in engineering	____	____	____	____

OPINIONS ABOUT MITE

	1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree
Attending the MITE program raised my hopes of attending college and having a professional career	____	____	____	____
I wish that I had not participated in MITE	____	____	____	____
I learned a lot about engineers and engineering from the MITE program	____	____	____	____

	1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree
The MITE experience frequently was unpleasant	____	____	____	____
I learned some things about myself from the MITE experience	____	____	____	____
The MITE experience made me realize that engineering is not for me	____	____	____	____
Participating in MITE made college professors, deans, and admissions officers seem more human, real, even likable	____	____	____	____
I would recommend the MITE program to a friend	____	____	____	____

I have talked to the following people about my experience in the MITE program (check as many as apply).

Principals	____	Friends	____
Teachers	____	Relatives	____
Counselors	____	Students	____
Parents	____	Classes, assemblies,	____
Other adults	____	or other groups	

What are the most important ways participating in MITE affected you (use extra sheets if necessary)?

A form like this cannot tell us everything that is important for us to know. If you were talking to a new group of students, what would you want them to know about the MITE program? Or, if you were talking to the sponsors of the program, what would you like to see changed? (Use extra sheets if necessary.)

Have you attended any other special summer programs for minority students, either in engineering or in other fields?

No _____

Yes, the following other MITE programs:

_____

_____

_____

Yes, the folloiwng programs that are not part of MITE:

_____

_____

_____

Give the name and address of someone who will know your address if you move.

Name: _____

Address: _____

_____

City State Zip

APPENDIX D

FOLLOW-UP QUESTIONNAIRE FOR NON-PARTICIPANTS

MITE PROGRAM QUESTIONNAIRE FOR NON-PARTICIPANTS

Student's name: _____
Address: _____
_____
City State Zip

Social Security Number: _____

Are you (check one)...? Female _____ Male _____

Name of your high school: _____
Address: _____
_____
City State Zip

EDUCATIONAL PLANS

Use checks to indicate your best guess as to the chances you will go to college, graduate from college, and study engineering in college.

	1. No Chance	2. Very little Chance	3. Some Chance	4. Very good Chance
Go to college	_____	_____	_____	_____
Graduate from college	_____	_____	_____	_____
Study engineering in college	_____	_____	_____	_____

What is the highest level of education you expect to complete (check one)?

High School diploma _____
Vocational or technical program _____
Associate degree _____
Bachelor's degree (M.A., M.S., etc.) _____
Doctor of Philosophy or Education (Ph.D. or Ed.D.) _____
Doctor of Medicine, Dentistry, etc. (M.D., D.D.S., or D.V.M.) _____
Law Degree (LL.B. or J.D.) _____
Other (specify) _____
_____

Were you planning to study engineering in college before applying to MITE?
No _____ Yes _____

Have you sent in an application for admission to college? No _____ Yes _____

If yes, where? _____
when? _____
what field of study? _____

If no, do you plan to apply for admission to college?
No _____ Yes _____

If yes, where? _____
when? _____
what field of study? _____

Are you now planning to study engineering in college?
No _____ Yes _____

Check the courses in math or science you are now taking or will take this year:

Algebra	_____	Biology	_____
Plane geometry	_____	Physics	_____
Solid geometry	_____	Chemistry	_____
Trigonometry	_____	Other science (specify)	_____
Calculus	_____	_____	
Other math (specify)	_____		
_____			

VOCATIONAL PLANS

My present career choice is (if possible, name an occupation):

_____ _____

If I could not have my first career choice, I would select the following occupation:

_____

If I could not have my first two career choices, my third choice would be:

_____

Are you interested in engineering as a career?

No _____ Yes _____

If yes, what fields of engineering interest you the most?

1st choice: _____
2nd choice: _____
3rd choice: _____

How satisfied are you with your present choice of a career (check one)?

Well satisfied with choice	_____
Moderately satisfied but with some reservations	_____
Not sure	_____
Dissatisfied but intend to remain	_____
Dissatisfied and intend to change	_____
Undecided about future career	_____

The following roles cut across a number of jobs. Which ones do you anticipate will be part of your work (check one answer for each role)?

Roles:	1. Not a part of my work	2. A minor part of my work	3. A major part of my work
Researcher	_____	_____	_____
Teacher	_____	_____	_____
Administrator or Supervisor	_____	_____	_____
Promoter or Salesman	_____	_____	_____
Practitioner (e.g. practicing engineer)	_____	_____	_____

OPINIONS ABOUT COLLEGE AND ENGINEERING

We need your opinions about the following sentences. Put a check in the blank by each sentence that best expresses your opinion.

	1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree
I have a clear idea of what I have to do to go to college	____	____	____	____
It would be very difficult for a student like me to get good grades in college	____	____	____	____
I am confident that my current career choice is right for me	____	____	____	____
I am <u>not</u> good enough at math and science to be an engineer	____	____	____	____
I have a clear idea of what it is like to be an engineer	____	____	____	____
I believe that minority groups and women are <u>not</u> welcome in engineering	____	____	____	____

OPINIONS ABOUT MITE

I would recommend the MITE program to a friend.

1. Strongly disagree ____
2. Disagree ____
3. Agree ____
4. Strongly agree ____

APPENDIX E

SUPPLEMENTARY TABLES

Table E-1

% Non Academic Competencies and Achievements by Sex for 1977 MITE Participants

Competencies or Achievements	Percentages		
	Males	Females	Total
I have used simple tools, such as a saw or hammer to build or repair something.	91.7	67.8	81.0**
I have changed a part or a car engine, such as a battery, spark plug, water pump or generator.	58.2	7.9	35.7**
I have helped others to solve their personal problems.	76.3	89.4	82.1**
I have taken apart and reassembled clocks, radios or other devices.	51.1	19.4	36.9**
I have paid a bill or purchased something with a money order.	71.7	73.4	72.5
I have worked regularly for pay.	65.9	55.0	61.0**
I have had a job when my friends wanted a job and couldn't find one.	58.0	48.2	53.6**
I have earned one or more raises or promotions because of good work.	26.3	14.2	20.9**
I know the odds for playing craps, poker and so on.	31.3	16.7	24.8**
I can learn new dance steps easily.	49.8	70.0	58.8**
I know how to be a successful leader.	63.2	68.5	65.6
I can repair furniture.	53.4	29.3	42.7**
I can make simple repairs on a TV set.	33.5	10.6	23.3**
I can use woodshop power tools such as a power saw or lathe.	66.7	18.2	45.1**
I know how to use electrical test meters (volt, amp, ohm).	37.3	13.7	26.8**
I can adjust a carburetor.	25.4	1.1	14.6**

Table E-1
(Cont.)

Competencies or Achievements	Percentages		
	Males	Females	Total
I can refinish varnished or stained furniture or woodwork.	53.4	34.9	45.2**
I can read blueprints.	35.0	14.0	25.6**
I can make simple electrical repairs.	53.8	12.8	35.5**
I can make mechanical drawings.	40.0	9.7	26.5**
I can name three foods that are high in protein content.	75.2	77.3	76.1
I can explain the "half-life" of a radio-active element.	42.4	28.2	36.0**
I can program a computer.	19.2	18.9	19.9
I can explain how to integrate a mathematical function.	26.3	17.8	22.5**
I can use a microscope.	91.1	91.0	91.1
I can explain why some man-made satellites do not fall to earth.	40.2	15.3	29.1**
I can play a musical instrument.	46.9	54.5	50.3*
I can sketch people so they can be recognized.	21.6	18.7	20.3
I am good at explaining things to others.	60.7	66.9	63.5*
I have won a prize or award for scholarship.	44 2	42.8	43.6
I was elected president of one or more student organizations (recoganized by the school).	26.1	33.3	29.3*
I received a high rating (good, excellent) in a state music contest.	6.5	7.7	7.0
I placed first, second or third in a school science contest.	11.6	11.7	11.6
I participated in a state or regional debate contest.	3.4	2.5	3.0
I had a major part in a play.	23.2	19.8	21.7
I won a varsity letter (sports).	46.2	31.3	39.6**
I did an independent scientific experiment (not as part of a course).	22.5	13.3	18.4**

Table E-1
(Cont.)

Competencies	Percentages		
	Males	Females	Total
I won a prize or award in an art competition.	15.0	11.0	13.3
I edited the school paper, yearbook or literary magazine.	10.9	15.5	13.0*
I had poems, stories, essays or articles published.	18.7	23.2	20.7
I participated in a National Science Foundation summer program.	4.5	2.0	3.4*
I placed first, second or third in a regional or state science contest.	2.4	2.5	2.4
I was a member of a scholastic honor society.	43.3	56.1	49.0**
I won a prize or award (of any kind) for scientific work or study.	16.8	17.6	17.2
N	551	445	996
%	55.3	44.7	100.0

* $p < .05$; ** $p < .01$;

Table E-2 : Factor Matrix of Competencies and Achievement Items by Sex

Items	Males					Females				
	I	II	III	IV	h^2	I	II	III	IV	h^2
Used sample tools	273	006	160	173	132	388	-048	091	-057	165
Changed part on a car	460	-019	027	244	272	350	071	148	003	149
Helped solve others personal problem	055	086	362	248	203	029	088	318	105	121
Taken apart clocks, etc.	486	-024	170	033	067	448	114	-065	046	220
Paid bill with money order	094	121	072	242	087	180	071	193	188	110
Worked regularly for pay	039	0	-039	614	380	003	005	076	763	588
Had job when friends couldn't find one	066	-015	031	646	422	080	-045	137	785	644
Earned raises or promotions	094	110	084	446	227	156	101	177	310	162
Know odds for craps, poker, etc.	137	122	158	085	066	308	139	017	108	126
Learn new dance steps easily	066	134	210	178	098	055	102	336	112	139
Know how to be a leader	090	172	373	282	257	108	232	486	033	303
Can repair furniture	564	051	027	136	340	634	000	069	070	410
Simple repairs on a TV set	473	-024	181	040	259	469	-005	-078	064	230
Can use woodshop power tools	557	066	-056	160	343	524	-034	099	-069	291
How to use electrical test meter	459	014	195	-059	252	296	-056	183	025	125
Can adjust carburetor	442	-088	057	289	290	278	105	094	039	099
Can refinish furniture or woodwork	511	184	050	258	365	514	080	170	063	303
Can read blueprints	312	124	167	-026	141	381	057	223	-072	203
Can make simple electrical repairs	638	-019	166	021	435	521	006	034	052	275

Table E-2 (Cont.)

Items	Males					Females				
	I	II	III	IV	h^2	I	II	III	IV	h^2
20. Can make mechanical drawings	306	145	002	-088	122	356	-022	085	-062	138
21. Can name 3 foods high in protein	151	060	405	110	203	151	060	398	060	189
22. Can explain hulflife of radioactive element	049	061	416	-108	190	010	-065	301	-135	113
23. Can program a computer	083	137	288	-078	114	201	048	102	136	072
24. Explain how to integrate math functions	147	004	235	-006	077	119	-003	251	048	079
25. Can use a microscope	173	009	321	111	146	114	065	245	095	087
26. Explain why satellites do not fall	239	-011	469	-015	277	190	-013	247	-137	116
27. Can play musical instruments	027	096	302	033	102	094	208	142	-064	076
28. Can sketch people	171	177	133	033	079	375	083	078	070	159
29. Good at explaining thi[illegible]	164	150	379	208	236	158	161	440	051	247
30. Won [illegible]e or award for scholarship	-013	277	271	105	162	003	320	235	099	168
31. Elected president of 1 or more student organizations	-044	413	183	218	253	-042	109	306	015	107
32. High rating in state music contest	-081	111	179	107	062	042	225	124	-011	068
33. 1st, 2nd, or 3rd in in school science contest	087	599	018	-065	370	024	603	-010	016	364
34. Participated in state or regional debate	-080	158	081	055	041	-024	-051	-019	032	005
35. Had major part in a play	097	199	222	113	111	119	217	097	080	077
36. Won a varsity letter (sports)	045	035	039	142	025	108	-063	222	037	066

Table E-2 (Cont.)

Items	Males					Females				
	I	II	III	IV	h^2	I	II	III	IV	h^2
Did independent science experiment	187	383	213	047	230	172	487	117	029	281
Won prize or award in art contest	132	221	114	072	085	329	161	001	074	139
Edited school paper, yearbook, magazine	042	214	106	102	069	052	155	188	011	062
Had poems, article published	006	214	219	140	113	025	034	232	033	057
Participated in NSF summer program	028	108	089	-001	123	-017	130	004	023	018
1st, 2nd, or 3rd in regional science contest	001	486	023	-012	251	-077	479	-058	015	239
Member of scholastic honor society	-056	219	168	033	081	-123	157	250	-078	108
Prize or award for science work, study	052	534	028	046	290	076	392	091	004	168
Eigenvalues for unrotated factors	5.25	2.62	1.98	1.77		4.65	2.43	1.91	1.76	
% of total variance for unrotated factors	11.9	6.0	4.5	4.0		10.6	5.5	4.4	4.0	
Number of subjects	551					445				

Table E-3 : Education of Parents of 1977 MITE Participants

Education	Father		Mother	
	N	%	N	%
Grade school/some high school	184	21.1	184	19.8
High school diploma	206	23.5	258	27.9
Vocational/business school	58	6.6	62	6.7
Some college	141	16.2	144	15.5
Bachelor's degree	87	10.0	91	9.8
Some graduate/professional school	87	10.0	95	10.2
Graduate/professional degree	110	12.6	94	10.1
TOTAL	873	100.0	928	100.0

Table E-4 : Occupational Categories of Parents of 1977 MITE Participants

Occupations	Father		Mother	
	N	%	N	%
Professional/technical	211	24.0	273	29.1
Manager/administrator	107	12.2	35	3.7
Sales	24	2.7	25	2.7
Clerical	71	8.1	146	15.5
Craftsmen	145	16.5	2	.2
Operatives	74	8.4	73	7.7
Transport	37	4.2	4	.4
Laborers, except farm	53	6.0	5	.5
Farmers/farm managers	9	1.0	2	.2
Farm laborers	3	.3	-	-
Service workers	59	6.7	88	9.3
Private household	1	.1	7	.7
Homemaker	-	-	237	25.2
Other[a]	86	9.8	45	4.8
TOTAL	880	100.0	942	100.0

Table E-5: Family Income Reported by 1977 MITE Participants

Family Income	Males N	Males %	Females N	Females %	Total N	Total %
Less than $2500	13	3.7	5	2.0	18	3.0
$2500 to $3999	16	4.5	15	6.0	31	5.2
$4000 to $5999	28	8.0	17	6.8	45	7.5
$6000 to $7999	24	6.8	21	8.4	45	7.5
$8000 to $9999	37	10.5	25	10.0	62	10.3
$10000 to $14999	83	23.6	54	21.8	137	22.8
$15000 to $19999	58	16.5	34	13.7	92	15.3
$20000 to $24999	38	10.8	30	12.0	68	11.3
$25000 or more	55	15.6	48	19.3	103	17.1
TOTAL	352	100.0	249	100.0	601	100.0